The Impact of Glassblowing on the Early-Roman Glass Industry (circa 50 B.C. – A.D. 79)

PRIOR, JONATHAN,DAVID

THE IMPACT OF GLASSBLOWING ON THE EARLY-ROMAN GLASS INDUSTRY (*CIRCA* 50 B.C. – A.D. 79)

BY JONATHAN DAVID PRIOR

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ABSTRACT

The Impact of Glassblowing on the Early-Roman Glass Industry (*circa* 50 B.C. – A.D. 79) by Jonathan D. Prior

In the late 19th and early 20th centuries, ancient glass was frequently treated as though it was a prestigious product, owned only by the elites of society. Research was primarily art-historical, and focused on select museum pieces. As archaeology developed, it became clear that glass vessels were used at many, if not most, Roman sites, from the late first century B.C. onward, and in many different social contexts, contradicting the idea that only the rich could afford them. Scholars began to explain the increased prevalence of glass by arguing that the invention of glassblowing (*circa* 50 B.C.) had increased production speed while lowering production costs, making glass vessels cheap and widely available across the social spectrum This thesis explores the role of blown glass by comparing the percentages and forms produced by older casting techniques in glass vessel assemblages from military sites, civilian sites, frontier settlements, and settings at the heart of the Roman world. It seeks to understand the social and economic status of blown glass and cast glass: why did cast glass persist after the invention of cheaper blown glass? Was cast and blown glass equally accessible to different levels of society? And to what extent can the invention of glassblowing bear responsibility for the rise in glass vessel use in the Roman world? By drawing comparisons between vessels from different production methods, and from different social and geographical contexts, this thesis begins to identify emerging patterns in glass use across Roman society and finds that both cast and blown vessels were used across all levels of society and that there was no strict divide between the use of casting for luxury wares and glassblowing for cheap utilitarian wares.

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Chapter 1 : Introduction and Literature Review

1.1 Introduction

The study of archaeological glass is an expanding field, which began primarily as an art-historical subject, focused on select museum pieces (Cool and Baxter 1999: 74). It has since branched into studies of production, and an increasingly scientific field utilising chemical analysis to work out composition and attempt to discover provenance. There have been studies of the use and production of glass covering the entire known history of manufactured glass, but there is still relatively little known about actual usage patterns and the role of glass vessels in ancient societies. Archaeological glass is rare in Bronze Age through Classical Greek contexts, but it is found regularly in Roman contexts from the first century B.C. onward. This increase in the presence of glass in archaeology coincides with the earliest evidence (*circa* 50 B.C.) for the discovery that the breath of a glass worker could inflate a bubble of glass, or *paraison* (Avigad 1971: 199; Gorin-Rosen 2000: 56; Grose 1977: 12; Harden *et al*. 1987: 88; Israeli 1991: 47; Israeli 2005: 54-57). The new technology of glassblowing allowed for much more rapid production and a much wider variety of vessels than core-forming, cutting, or mould-pressing techniques, and is still the basis for mechanised glass production today (British Glass Manufacturer's Confederation 2013). In spite of the resulting prominence of glass in the Roman archaeological record, there is still relatively little that is clearly understood about the use of glass in Roman society, the role of glass in the Roman economy, how widely glass was used, or the true impact of the new technology of glassblowing, which is arguably the greatest development in the history of manufactured glass production (Grose 1977: 9).

It has often been assumed that, because of the coinciding time-frame, glassblowing itself was responsible for bringing the sudden increase in the frequency and number of glass finds in the late Republic and early Empire and for enabling the general population to afford glass vessels (Grose 1977: 9[1]; Harden *et al*. 1988; Isings 1957: 1; Stern 1998: 535; Vickers 1998: 17). Past display and publication of Roman glass routinely suggested that it was primarily a luxurious, decorative medium utilised by the upper echelons of society, and only by looking onto excavation finds catalogues could one see that the use of glass was widening in the Roman world (Vickers 1998: 17; Harden *et al*. 1988). This expansion in use has traditionally been put down to a technological change (Isings 1957: 1, 14). The high speed of production, made possible through glassblowing, is often used as evidence that glassblowing would have made glass vessels more affordable, because more objects would be produced in a shorter time period, making more pieces available for purchase. Isings (1957: 1) even argues that it was the relative ease of glassblowing that allowed workers to set up workshops and begin local production in Italy and the West rather than importing expensive, mould-pressed, Egyptian glass, hinting at a traditional bias towards cast glass always being expensive and produced in the East. The strong presence of glass in Roman archaeological settings does support the argument that glass was accessible in the early Roman period, but although logic would state that widely available objects would decrease in price, it is impossible to quantify the effect that glassblowing had on the cost of glass due to the dearth of evidence for glass vessel costs prior to the fourth-century Maximum Price Edict of Diocletian. This document, however, only compares colourless glass to natural coloured glass, rather than comparing blown vessels to

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[1] Grose credits glass with being a major advancement, is a bit reserved in the argument that glassblowing was responsible for its cheapness and availability. Even later in his 1977 article he hints that other techniques may have already begun making glass popular.

vessels produced in other ways (Graser 1940; Price 2005: 179; Roueché 1989: 265-361; Stern 2004: 106; Stern 1999: 461).

The archaeological record certainly supports the suggestion that glass use took off in the early Roman world, was used at all levels in Roman society and that it was found at virtually every late-Republican and Imperial site. It was even valued enough in the Roman world that many ancient writers, from Pliny the Elder (*Nat. Hist.* 36.193), to Strabo (*Geog*. 16.2.25), to Martial (*Ep.* 1.41.3-5 and 10.3.3-4) and Juvenal (*Sat.* 5.47-48), as just a few examples, commented on it. The authors who use this evidence to support the belief that glassblowing changed glass from a luxury item to a common item show no real evidence that correlation equals causality. There has been very little, exploration into the actual level of glass use immediately on either side of the invention of glass use, and in one of the few pieces of writing that comments directly on glass use just prior to glassblowing, David Grose (1989: 241) indicates that new casting techniques may already have been speeding up production and spreading glass use. The fact that Romans were using glass widely meant that the demand could outpace production by any method aside from glassblowing, potentially making it the most common method by necessity. It is entirely possible that demand drove the use of new technology, rather than technology driving demand. Stuart Fleming, for instance, argued that glass became a rival to pottery (a somewhat extreme view, which requires more support or qualification than he provides), and estimated that by the second century A.D., as many as eight million households within the Empire would have been using 60 or more glass items in an average day.[2] He then uses this number to calculate demand and make an estimation of a necessary production level of 100 million vessels annually to meet the Roman demand for glass vessels, accounting for an average breakage level

[2] Fleming does not actually explain how he comes to this estimate, or how he uses the data to calculate demand and production so this estimate must be viewed sceptically.

of 12 items per household per year (Fleming 1997: 3; 1999: 60). Marianne Stern emphasises the tremendous rate at which glassblowing took off by stating that glass vessels outnumbered thin-walled ceramics at Pompeii by as much as two or three to one (Stern 2004: 103), seemingly implying that this was representative of the Roman world in general. These arguments suggest that glassblowing had a radical impact on the level of glass use in the Roman world, but they may be based on cherry-picked results and may overstate the use of glass in relation to ceramics.[3]

The argument for glassblowing deserving the bulk of the credit for widespread Roman glass use has been losing some support in the last twenty or thirty years (Cool 2006; Cool and Baxter 1999; Grose 1989). Even Grose, who in much of his work comments on the great significance of glassblowing, implies that it was not entirely the cause of a shift in usage. He suggests, as noted above, that advanced casting techniques were already reducing the time and costs required to produce glass vessels, and that glass use was becoming common even in the years leading up to the invention of glassblowing. Grose (1989: 241) argues that casting techniques such as sagging were vital to the growth of the glass industry, and were only gradually replaced by blowing. He does not in any way suggest that glassblowing was insignificant. In fact, in his 1977 paper for the *Journal of Glass Studies* he explicitly states that glass shifted from a luxury product to a commonplace one when the new glassblowing technology revolutionised the industry (Grose 1977: 9), and he fully recognises that it was a technological advancement that allowed for major changes in the variety of possible forms and the speed of production. He argues that the aesthetic and utilitarian qualities of blown glass quickly made it a preferred substance for tableware, for the storage, preservation, and transport of goods (Grose 1977: 9). What Grose's argument suggests,

[3] Stern's statement is not backed up with data in her article, but chapter six of this thesis works out how this number could be obtained and how reliable it is for calculating the relationship between glass and pottery.

however, is that glassblowing's role in changing usage is greatly over-stated. Grose notes that blown vessels of the late first century B.C. and early first century A.D. were becoming more popular, but when he comments that authors like Seneca and Petronius both marvelled at the low cost, the speed at which glass became common, and the novel qualities of glass – such as its lustre, transparency, and lack of odour and taste (Petronius, *Satyricon* 50; Seneca, *Epistulae Morales* 90.31) – he remarks that no Roman author provided specifics on the production types behind the glass on which they wrote (Grose 1989: 242). Furthermore, the production advances facilitating the manufacture of glass and producing a variety of colours in Grose's work relate to casting more than to glassblowing (Grose 1977: 13-14).

In spite of some movement away from the idea that glassblowing made vessel glass widely accessible there are few who have taken the time to discuss the impact of glassblowing on a similar scale to Isings, Fleming, and especially Stern. This thesis therefore seeks to explore archaeological evidence for both sides of this argument – that glassblowing made glass affordable to the masses (*i.e.* all levels of society, not just the wealthy elites of equestrian and senatorial rank), and that glass had already begun to have widespread use that was simply accelerated by glassblowing – through a series of case studies, which evaluate what roles blown and cast glass vessels actually played in the lives of people across the Empire in the first century and a half after the invention of glassblowing, and the ratios of each that are represented. Tracing usage over time on numerous individual sites has proven impractical due to the scarcity of sufficient sites with adequate assemblages spanning pre-and post-glassblowing contexts, in sealed datable sequences. Therefore, this thesis will primarily study the relationships between production techniques and the vessel types that were popular following the invention of glassblowing. By looking at forms, colours, and numbers of vessels formed through glassblowing and older casting techniques it will be possible to evaluate the level to which older techniques were still valued, and whether older techniques produced vessels that were widely affordable and utilitarian, or whether the cost and speed of casting restricted it to the production of costly luxury items.

The prominence of glassblowing is impossible to ignore, and one must suspect that it played some part in accelerating the spread of glass simply by making more items available, or serving as a response to demand. It is important to look at evidence for the use of cast glass in the Roman world to understand if it actually was available to people in a range of economic standings, how widely it was used, and whether sagged forms that were easily produced were widely used both before and along side blown glass. The possibility that the use of glass had already begun to spread socially must be considered, and that the huge explosion of glass across the Empire had more to do with the spread of Roman hegemony and safe trade routes, which came to include the major regions of glass production, such as Phoenicio-Syrian Coastline in 63 B.C. and then Egypt in 30 B.C. (Grose 1977: 10), than with the invention of glassblowing. The *Pax Romana*, which was established *circa* 30 B.C. following the civil war between Octavian and Marcus Antonius, would have allowed craftsmen and traders to easily move about the Empire and spread glass use, whether through casting or blowing. The concentration of crafts in Italy, and the import of craftsmen and slaves from the newly acquired territories of Judea and Syria, would have exposed more people to glass and allowed for vessels to be produced locally in the heart of the Roman world (Fleming 1997: 3). In this scenario, the technology may take secondary importance behind the political and economic climate.

1.2 Literature Review

Before tackling raw data and trying to answer the core research questions about the true impact of glassblowing, it is important to gain a broader understanding of the role of ancient glass prior to the invention of glassblowing, and the work that has been done on the use of glass in the Roman world. This section will explore the spread of manufactured glass, from its roots in Bronze Age Mesopotamia and Egypt up to the invention of glassblowing and Roman glass in the first century and a half after the invention of glassblowing, and will explore the methods and technology of production to understand how it may have impacted the accessibility and use of glass. It will touch briefly on the availability and popularity of glass, and how widely glass vessels were used, and what their role in society may have been. This chapter begins with examining the history of glass and what little is known about its place in society before moving on to looking at what has been said about the changing forms and methods of production, which have been the primary focus of glass literature. The latter part of the chapter will explore the treatment of glass in literature and archaeological record, including the relatively small body of work on the reception of early-Imperial glass. This will address the problems with the way glass has been discussed and the difficulties of dealing with glass in this historical context, and will set the stage for the new research presented herein and how this thesis hopes to address the issues that exist within this field of study. This chapter will conclude with a brief example of data presented in an example of a glass assemblage from the Israeli site of Tel Anafa. This will illustrate the role of glass in a settlement under the Roman sphere of influence immediately before and after the invention of glassblowing to serve as a sort of baseline, by which we may judge the impact of glassblowing on usage.

1.2.1 Early History of Glass

When trying to understand the changes in the glass industry of early-Imperial Rome and how different production types relate to one another, it is useful to understand the traditional roles played by glass and glass vessels before the rise of Rome. This will help to establish the level of truth to the argument that glass vessel use held a position of prestige throughout its pre-glassblowing history. It is also of key importance to understand the basics behind how each significant production method worked, since streamlining production – making glass cheaper and faster to produce, and therefore, more widely available and affordable to people beyond the wealthy elites of society – is the basis of the argument in favour of glassblowing as the driving force behind widening usage.

1.2.1.1 Origins of Glass

The archaeological record shows that glazed objects were produced as early as 4000 B.C., and that objects fabricated entirely out of manufactured glass, have been produced since as early as the middle of the third millennium B.C. (Harden 1956: 311; Pfaender 1983: vii), but there is no archaeological or historical source that can provide a clear start date. The first written record that discusses the origins of manufactured glass dates to the Roman period, nearly 3000 years after the earliest archaeological glass. The legend claims that natron traders accidentally discovered the method of producing glass when they used their cargo to support their cooking pots on a beach, and that the fire had caused the natron and the sand to fuse and form glass (Pliny the Elder *Nat. Hist.* 36.198). Regardless of the truth of this anecdote, Pliny is likely correct in suggesting that the discovery that man could make glass came from observing accidental vitrification of sandy material while working with fire since, as Bill Bryson neatly pointed out with the words "Call me obtuse, but you could stand me on a beach until the end of time and never would it occur to me to try to make it into windows" (Bryson 1996: 111), the process of mixing sand and an alkali at high temperature to make glass certainly is not intuitive. Due to the temperatures required to make glass, however, Pliny's cooking pot story is not likely to be true, and a much more reasonable scenario would be that glass was discovered by noticing vitrification in high-temperature furnaces used for other fire-based industries like pottery making, bronze smelting, or making faïence, the last of which utilises the same raw materials as glass (Moorey 1994: 167, 189; Pfaender 1983: 1).

Based on the earliest documented glass finds, the first glass production probably occurred in either Egypt or Mesopotamia with most experts leaning toward the latter, citing evidence that some Mesopotamian glass may predate Egyptian finds, the earliest of which only date to around 1500 B.C. (Shortland 2012: 57, 60), by up to 1000 years. Glass items become relatively regular finds in Mesopotamian contexts from about 1600 B.C. – 1100 B.C. (Newton 1980: 176; Nicholson and Jackson 2000: 11; Shortland 2012: 47).

1.2.1.2 Glass From the Bronze Age Through the Hellenistic Period.

There is evidence for glass being connected to the highest levels of society in the earliest civilisations in which it is found. The evidence comes not only from the dearth of glass finds, and the temple and palace contexts from which the limited glass finds come, which could be skewed due to the relative ease of identifying palaces and temples and the traditional interest in such lavish contexts, but also from primary-source documentary evidence. Documentary evidence, is in fact one of our most valuable sources due to the small number of actual glass finds, and the fact that glass of the fourth through early second millennia B.C. can be too badly corroded to recognise.

Documents from the royal archives of Amarna (the Egyptian capital from *circa* 1353-1332 B.C.), for example, show that even the trade of raw glass, not to mention worked glass objects, was something that took place between kings. The pharaoh Akenaten is recorded as trading glass with the kings of Tyre and other Eastern Mediterranean cities (Tatton-Brown and Andrews 1991: 24).

Glass technology may have been something that was sought after as a part of the spoils of war. The first arrival of glass production in Egypt seems to coincide with the military campaigns of Tuthmosis III (1479-1425), into Syria and to the borders of Mesopotamia, from which he could have brought back workers to create an Egyptian industry, rather than relying on foreign trade. Egyptians carried on using core-formed mosaic glass styles similar to those in Mesopotamia, but with their own sets of forms, as did the people of the Aegean, who imported Mesopotamian glass in the late Bronze Age (Tatton-Brown and Andrews 1991:28; Shortland 2012: 162-163; Stern 1999c: 36-37).

Glass ingots were traded into the Aegean where the Mycenaeans were using both imported glass items and objects of their own design,[4] produced from imported glass (Shortland 2012: 162-163). Although the Mycenaeans largely used imported glass, Linear B tablets suggest by the end of the Mycenaean age (*circa* 1200-1100 B.C.) they may have been producing some of their own raw glass. This is backed up by chemical analysis, which shows that their glass contains a plant ash flux differing from that used by the Egyptians or Mesopotamians of the time, and the levels of metal oxides used to colour the glass were also distinct[5] (Nikita and Henderson 2006: 75-119).

Glass became scarcer in the Mediterranean following the end of the Bronze Age and only began to recover in the ninth century B.C. in the form of inlays (mostly

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[4] Excavations at Mycenae's citadel have turned up some bead moulds, and a few game pieces, as well as a fragment of a bull-shaped inlay from a typically Mycenaean style of sword hilt (Shortland 2012: 162-163).

[5] Mycenaeans used higher levels of zinc, nickel, and manganese in their glass (Nikita and Henderson 2006: 75-119).

monochrome) in ivory plaques and panels decorating luxury furnishings. Vessel use began to recover more slowly about a century later in the form of small hemispherical bowls, occasionally with mosaic inlays. True mosaic bowls did not reappear until the third century although small Mesopotamian style, *oenochoe, lagyoni* (jugs), and *alabastra* as well as jewellery items such as core-formed beads brooch runners, and bracelets had begun being appearing in in the seventh and sixth centuries with circumstantial evidence pointing to a production centre on Rhodes[6] (Tatton-Brown and Andrews 1991: 38-41; Triantafyllidis 2009: 26-34). Between 550 and 50 B.C. Mediterranean workshops produced core-formed vessels based on contemporary Greek metal and ceramic vessels. These small vessels came in strong colours, and were found in all major Greek centres (Stern 1999c: 36-37; Tatton-Brown and Andrews 1991: 42-43).

Glass had a place of prestige in Greek architecture and sculpture. It was used as inlays on the capitals on the North porch of the Erechtheion on the Athenian acropolis,[7] as inlays for statue eyes, as in the Delphi charioteer and the Riacce Bronzes, as well as for sculptural clothing folds such as those that were used in Pheidias' seated Zeus statue from Olympia[8] (Pedley 2007: 234; Stern 1999c: 39).

Glass was also incorporated into luxurious gold and silver jewellery. Stern (1999c: 21) cites, as an example, a gold ring with a glass inlay from the Kerch peninsula and a similar silver ring from Thessaly. Gold rings with glass inlays are also well known from Hellenistic tombs from southern Italy (De Julius *et al.* 1989: 295-301). Glass was also worthy of note in literature; first being recorded in Aristophanes'

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[6] This is based on a concentration of core-formed vessel finds in Kamiros on Rhodes (Triandyllidis 2009: 26-34).
[7] Brightly coloured inlays were still visible on the Ionic capitals of the Erechtheion until the 19th century (Stern 1999c: 37).
[8] Although the statue itself is lost, glass moulds for cloth folds were found it Pheidias' workshop at Olympia (Stern 1999c: 39).

Acharnai verses 72-73 where returning Athenian ambassadors report that the Persian court drank out of vessels of glass and gold, placing both materials in a high courtly standing (Stern 1999c: 23). This matches up with archaeological records of the time, which shows the Persian aristocracy using horizontally ribbed bowls, ribbed phials, and ovoid beakers (Schmidt 1957: 91). Aristophanes also mentions glass in *Clouds* verse 768 using the term *hyalinai* to describe something transparent. The same term is used in a *testamonium* of goods dedicated at the Parthenon from 399-398 B.C. to describe multi-coloured gems. The only material available at the time that could be both multi-coloured and transparent was glass (Stern 1999c: 20). Glass was clearly a material of some prestige as it is not a particularly common find in Classical Greek excavations, but it appears in temple dedications from the Parthenon from the years 405/404-370/369 B.C. and from the Athenian Asklepieion from the mid-fourth to the mid-third centuries B.C. The dedications included vessels, gems, jewellery, raw glass ingots, and even a glass ear (Stern 1999c: 20).

There was a last great surge of Mediterranean core-forming in the late Hellenistic between the 2nd and mid-first century that gave upper class Romans a taste for glass and produced a large quantity of luxury wares (Tatton-Brown and Andrews 1991: 44). The major late-Hellenistic style, which was common throughout the Greek word and the Roman Republic, consisted of mosaic vessels produced using multi-coloured canes often with spiral or star patterns interspersed with plain coloured or gold ‘sandwich-glass’ (clear glass with gold foil ‘sandwiched’ inside). Lacework or network glass was produced from canes of intertwining spiralled threads of different colours. There were also complete dinner services of plain, often decolourised glass. Common shapes included large plates, dishes, hemispherical bowls, mixing jugs or *kraters*, bowls with projecting bosses on the outer walls and linear-cut lotus petals spreading from a rosette on the bottom, and cups with winged handles. All of these forms were luxury items imitating hammered silver and bronze vessels (Tatton-Brown and Andrews 1991: 49). Though we have little archaeology to support it, there is textual evidence from the Roman period that many of the best of these wares came from Alexandria (Isings 1957: 1, 15; Tatton-Brown and Andrews 1991: 49).

1.2.1.3 Glass in the Roman World

The late-Hellenistic surge of core-formed vessels was impressive, but with the invention of glassblowing and its rapid spread, encouraged by Roman hegemony, core-forming would never again be the dominant form of glass production. Glassblowing allowed for rapid and inexpensive production of glass in a much greater variety of forms. This invention rapidly gained popularity and, although often mechanised today, it has been the dominant form of glass production ever since. Glassblowing is arguably the greatest advance in glass production since the craft's inception, even when considering modern fire glass and high-durability glass, because even they rely on the basic principals of glassblowing. Nevertheless, the origin of glassblowing is almost as hazy as the origin of manufactured glass itself. There are no ancient sources known that comment on the invention of glassblowing (Grose 1977: 12), and we cannot say for certain where, when, in what manner, or by whom glassblowing was invented.

For about a century, scholars put forward hypotheses on the origins of glassblowing – Isings (1957: 1) credits the Sidonians, for example – but it is only since the 1960s and 70s that we have begun to develop a good picture of the earliest glassblowing. The general emergence of blown glass has led most to agree that glassblowing must have been invented in the eastern Mediterranean sometime in the middle of the first century B.C. (Israeli 1991: 46). There have been detractors who argued that glassblowing was actually invented much earlier but never really caught on.

There was a 19th century B.C. tomb painting from Egypt that was once interpreted to show glassblowers, but Sir Flinders Petrie and others demonstrated convincingly that it was actually showing metal workers using tubes instead of bellows to create drafts. In addition, no blown glass has ever been found in Egypt that predates Roman occupation. Grose notes that an early argument suggested that glassblowing was used as early as 250 B.C. in Seleucid Mesopotamia (Grose 1977: 10-11), and Pfaender argues that glassblowing had existed around Sidon since around 200 B.C. only spreading out of the region as a result of Roman trade (Pfaender 1983: 3-4). The argument for the Seleucid blown glass was based several glass pieces with smooth interiors and exteriors (Grose 1977: 10-11). G. Eisen suggested that the earliest glassblowing stemmed from a desire to produce vessels out of the same mosaic glass from which beads were produced. He suggested that workers just pinched the ends of beads, or tubes intended for beads and inflated them (Eisen 1916: 134; Israeli 1991: 46). There is, however no evidence for these claims regarding the earliest evidence of glassblowing, and all other similar claims have been discredited (Grose 1977: 11). The first major breakthrough came in 1961 when a small blown bottle was found among datable grave goods in a cave burial near En-Gedi, in the Judean desert. The ceramics among the grave goods are contemporary to those of an adjacent town site that was destroyed *circa* 40-37 B.C. This glass bottle predated all previously discovered blown glass (Grose 1977: 12). Another even more important find was made a decade later in a 1970-71 excavation by N. Avigad in the old Jewish Quarter of Jerusalem. He did not discover a workshop with unique glassblowing tools, but there was a workshop dump that contained clear evidence of glassblowing in a sealed mid-first century B.C. context. The dump was found in one of a group of abandoned cisterns and Jewish ritual bathing pools over which Herod the Great had built a road in 37-34 B.C. The find included glass rods, hollow glass tubes, partially blown bulbs of unfinished vessels, glass chunks, deformed fragments, cast bowls, and a number of smaller fragments. Some of the tubes had been pinched shut and heat sealed at one end to allow inflation from the open end. These have been interpreted as early experiments in glassblowing. The materials discovered here were not only stratigraphically datable, but it also contained ceramics and over 100 coins from the reign of Alexander Jannaeus (103-76 B.C.). The latest date for the dumping of the materials can safely be placed around 50-40 B.C. (Avigad 1971: 199; Gorin-Rosen 2000: 56; Grose 1977: 12; Harden *et al*. 1987: 88; Israeli 2005: 54-57; Israeli 1991: 47). This deposit is the earliest solid evidence that has been found to date for the practice of glassblowing, and it convincingly supports the hypothesis that glassblowing was invented in the Levant in the early first century B.C. It also partially supports Eisen's old idea that some of the earliest glassblowing was in fact experimentation with closing tubes of glass at one end and trying to inflate them from the other, possibly even without the use of a blowpipe (Israeli 1991: 47).

Other evidence that can be dated no more precisely than the first century B.C. has been discovered in the east at sites in Syria, Palestine, and Cyprus. Most of this early evidence is in the form of ordinary natural bluish/greenish colourless oil and perfume bottles. These styles also appear in first century A.D. contexts, along with non-blown wares, and show that the technique of glassblowing was spreading and being adopted in many regions of the Empire in the Augustan period.

Roman hegemony had just begun to extend to major regions of glass production about the time of glassblowing’s invention. The Phoenician-Syrian coastline came under Roman control in 63 B.C. and then Egypt, having already had close ties with Rome under the Consulship and Dictatorship of Julius Caesar, officially came under Roman control in 30 B.C. as Augustus secured power after the battle of Actium (Grose

1977: 10). As Rome consolidated power in the eastern Mediterranean and shifted from Republic to Empire, many craftsmen, likely including glassworkers, were brought back to Rome and Italy, bringing knowledge of their crafts and technologies with them (Fleming 1997: 10). In addition to slaves, free labourers gained greater mobility due to the relative peace and stability initiated by unified, Roman control of the region. This atmosphere of open and secure trade and travel spurred industrial growth, and by the Tiberian period, blown glass was common, and mould-blown glass was in regular domestic use (van den Dries 2007: 23).

As glass became popular throughout Roman society, in the first century A.D., it began appearing in literature and other forms of art. Blown vessels are visible on frescos at Pompeii and Herculaneum (Tatton-Brown 1991: 64-65), glassblowers are depicted at work on clay oil lamps from Dalmatia and Ferrara (Stern 2002: 159), and writers including Strabo noted production in Campania and Rome (Strabo *Geog*. 16.2.25). The archaeological record suggests that numerous workshops also existed in the Po Valley and at Aquileia in Northern Italy, and at Locarno and Vindonissa, in Switzerland (Tatton-Brown 1991: 66). Strabo was not the only Roman writer to comment on the impressive nature of glass during the period immediately following the invention of glassblowing. Pliny wrote *nec que est alia nunc sequacior material* "there is no other material nowadays that is more pliable (*Nat. Hist.* 36.198) and he listed *flatu figurare* or 'shaping by breath' as one of the glass-working techniques used in Sidon which he considered chief among production centres for high quality glass (*Nat. Hist.* 36.193). Petronius depicted glass as something that would be more valuable than all the gold in the Empire if it were not fragile (Petronius *Sat.* 51).

In spite of its importance as a form of glassblowing, free-blowing gets much less attention in the literature than mould-blowing does in the first century A.D. Grose suggests that this is because most free-blown glass of this period was naturally coloured and was non-decorative. The artistic taste of the time was leaning toward mould-blowing or cast mosaic glass, and until those styles declined free blowing was somewhat overshadowed. Plain, natural coloured tableware was the norm for free-blown glass from about A.D. 25 to the end of the Empire (Tatton-Brown 1991: 76), and this was of little interest to early archaeologists and collectors. Grose uses the example of glass from a possible shop storage room at Cosa (room 22.II),[9] which was destroyed by the collapse of the basilica wall between A.D. 40 and A.D. 45 to show the typical range of glass available for purchase at the time. Of the blown vessels present there, 36 were natural blue-green, three were light green, and one was colourless. Grose says that Cosa's glass was not unique, but rather that it was quite representative of the glass of its time in Italy and the West at the very least. Glass finds at Vindonissa in Switzerland, and Camulodunum and Fishbourne Villa in Britain showed similar results (Grose 1974: 42, 48).

Free-blown glass could, however, be highly artistic even in the first century A.D. when mould-blowing was in its prime. Decorative free-blown vessels included ointment containers like the birds with heat-sealed tails, as well as other forms such as *pecten* shells, which were also imitated in terracotta and silver, as were 12 examples from the silver hoard at Boscoreale. These kinds of decorative containers existed right alongside plain, heat-sealed, glass vials that were also used for ointments and perfumes (Giordano and Casale 2007: 22). Another free-blown form that appeared in the first

[9] Room 22,II contained over 200 Arretine vessels, 12 amphorae, over 40 clay lamps, and 76 glass vessels of 31 shapes that were mostly tableware. The vessels all lacked signs of wear suggesting that they were new and waiting to be sold (Grose 1974: 32-33; Price 2005: 180; Stern 2004: 105). This example as well as another from a building destroyed by fire, *circa* A.D. 50-55 or A.D. 60/61[9], in the Roman *colonia* at Colchester, England show that glass and ceramics were frequently sold along side one another. The example Colchester contained hundreds of South Gaulish Samian vessels, and a large amount of glass, which had melted so it is impossible to tell the number of vessels that were represented or what forms they took (Price 2005: 180)

century A.D. was the teardrop bottle for storing perfumes. This was one of the most persistent vessel forms and it remained popular for between 200 and 300 years (Tatton-Brown 1991: 76).

The actual trade of glass and its role in society is discussed in fairly broad terms, but rarely with data to compare it to other commodities. The general consensus is that most household items were sold and used in a fairly close proximity to where they were made, and many of the craftsmen likely sold their products locally out of shops attached to the workshops (Stern 1999b: 470). Much of this is speculation and we cannot tell if glassworkers were also retailers or if someone else took care of sales. Unless retail space was destroyed suddenly, it is usually difficult to tell what products were sold there, because a shop that simply closed would have been cleared out of its wares (Price 2005: 179-180). Extra rooms appended to workshops cannot always be proven to be retail for the products of the workshop either. The space could easily have been storage for cooling vessels, raw materials, or furnace fuel. Such a space could also represent a room where finished works were gathered and then sold to other producers who would fill the vessels with their wares before sale to the public, as was likely done in Puteoli and Pompeii where epigraphic evidence shows close working connections between incense dealers and glassworkers (Price 2005: 179), or to merchants or wholesalers who would then sell the wares to the public elsewhere. We do have evidence for wholesale of glass from several locations. Stern says that wholesale batches, containing over 600 vessels of approximately 40 shapes and subtypes, have been discovered in a Flavian context at Augsburg, and that they came from a northern-Italian workshop (Stern 1999b: 474). She also makes note of vessels at Herculaneum that were still packed in straw from shipping and divided into separate packages according to vessel shape (Stern 2004: 105).

Some glass was transported over a long distance, but it was not usually shipped in huge amounts and was not usually the main cargo of ships. Glass has been found in shipwrecks, but in most cases, such as a wreck near Antikythera in South-western Greece, it was filling up free space in cargoes of ceramics or statuary (Fleming 1999: 14). Other evidence for long-distance glass trade comes from a shipwreck six miles from Grado, near Aquileia, which contained ceramics, glass (mostly in cullet form), and other materials. It is not clear whether the glass was in cullet form before the wreck, so it is difficult to be certain whether this wreck indicates the trade pattern of glass, or of the contents of bottles, some of which bear the stamp of C. Salvius Gratus whose work was common in Northern Italy and Southern Germany (Stern 1999b: 468). A problem, therefore, arises when discussing the glass trade. Bottles were often sold with contents, and they represent the commerce of the contents rather than the commerce of glass (Stern 2004: 103). Squat, square-sided jars were easy to pack together in crates and were quite durable, which, combined with the fact that glass does not have a porous surface that absorbs its contents, or a surface that imparts a scent or flavour on its contents, made it ideal for transporting and storing spices, medicines, perfumed oils, balms, and lotions (Fleming 1999: 27). Tableware on the other hand was sold empty and can allow us to understand that aspect of the glass industry and measure distribution patterns (Stern 2004: 103).

Even though some large-scale, long-distance trade in glass did exist, most such trade was geared toward single decorative vessels rather than bulk imports (Stern 2004: 103). There is documentation of glassware being sold in sets, as sets have been found in Herculaneum, and in first-century tombs throughout the Empire at locations including Vervoz, Belgium; Saintes, France; Dalmatia; and Vize, in eastern Thrace (Stern 1999b:

471). Still, most sets have been made and sold in a fairly limited region unless they were high quality, decorated, luxury wares.

1.2.2 Methods of Glass Production

To understand the changing role of glass in relation to the introduction of glassblowing, it is necessary to understand how glass was made before this introduction and how glassblowing works in comparison.

1.2.2.1 Making Glass

Throughout the history of ancient glassmaking, raw glass was almost always produced in a separate process and separate location from where glass items were produced. It was usually made in large quantities at locations close to the raw material source and then shipped in the form of ingots, or large chunks, to the glass-working sites where it would be turned into a finished product (Gorin-Rosen 1995).

The raw production sites in the ancient world from the origins of glassmaking to the middle of the Roman Empire were quite limited to locations in the eastern Mediterranean and Mesopotamia due to the need for reliable sources of sand and natron (Aerts *et al.* 2003: 659-660). While glass can be formed from melted silica (sand, quartz, or flint) alone, which can be found in a wide variety of locations, making glass from this requires such high temperatures that it is only possible with modern furnaces. Even today it is impractical to produce pure silica glass for most purposes. To make glass production easier, an alkali flux of soda, natron, or potash, can be added to lower the melting temperature. The addition of the flux makes the glass soluble when subjected to extended contact with water, so a lime stabiliser must be added to the mixture for it to be useful. To achieve a full fusion of these materials the furnace must be able to maintain a temperature of about 1100ºC until the ingredients reach a fully liquid state (Fischer 2008: 19; Stern 2008: 524; Stern 1999b: 451, 454). The required duration varies depending on the size of the batch, but would have been around a week for some of the large-scale late-Antique furnaces that have been discovered in Israel, such as those at Beth Eliezer, Bet She'Arim, Haifa, and Jalame (Fischer 2008: 19; Freestone *et al.* 2009; Freestone and Gorin-Rosen 1995; Shortland 2012: 85-86; Weinberg 1988; Weinberg 1965: 9).

Glass working could be carried out at somewhat lower temperatures (700-1000ºC) because the glass often did not need to be returned to a fully liquid state to be shaped (Stern 2008: 524). For some production techniques the material only needed to be heated to a malleable state, or a state hot enough to fuse with the metallic salts or oxides for colouring, removing colour, or making the glass opaque. From there it could be shaped with tools or pressed into a mould (Saguí 2007: 218).

1.2.2.2 Glass Working

Glass working can be divided into three main categories; namely cold-cutting, casting, and blowing. Cold-cutting is the least common production category for vessels, and has virtually no bearing on this thesis as a production method, but it is sometimes used in conjunction with other categories as a finishing or decorating technique. Casting encompasses all production techniques that use hot glass in a mould or former to create the shape of the vessel without relying on inflation at any stage, and glassblowing involves the inflation of glass into an appropriately sized paraison, which can then be shaped through a variety of methods including the use of moulds or tools, or by swinging and rotating the blowpipe.

Vessels produced through cold-cutting are carved out of a lump of glass, using techniques akin to those used to produce stone vessels. There are limitations on the forms that can be produced, and the technique is time consuming. Furthermore, there is always a danger of breaking the object due to the fragile nature of glass, making it impractical for forming full vessels compared to heated glass, which is malleable, making the risk of breakage unnecessary.[10] As noted above, cold-cutting does not factor into this thesis, because of the almost complete absence of cold-cutting as a production method in the early Roman Empire other than for finishing decoration. In fact, only one vessel examined in the entire course of research for this thesis had any potential for representing a cold-cut vessel. That vessel was a miniature jug with a trefoil rim from the *Palaestra* at Herculaneum, and notes on the object suggest that it may even be rock crystal rather than glass (Scatozza-Hörricht 1986: 50, no. 102; Siano Unpublished no. 1437).

To form vessels, the most common method in the early pre-glassblowing period (*circa* 1,500 B.C. – the fourth or third century B.C.) was core-forming[11] (Shortland 2012: 47; Woolley 1955). Core-forming involved the creation of a solid clay archetype, in the shape that the glassworker wanted the vessel to take. Hot and malleable glass threads could then be wrapped around the core until it took on the desired shape, or the core could be dipped into molten glass, or rolled in chips of glass that could then be heated until they fused. Once the glass cooled, the core would then be chipped out leaving a hollow vessel. Mosaic vessels could be formed with this method by winding different coloured strips of glass around the core while each thread was still hot enough to fuse to the one next to it (Tatton-Brown and Andrews 1991: 23).

[10] Egyptians in the 15th century B.C. do appear to have drilled into cold glass ingots and worked them like stone to imitate a common type of Egyptian stone ointment jar that was popular in the middle kingdom, *circa* 1475-1425 B.C. (Shortland 2012: 57; Tatton-Brown and Andrews 1991: 33-34).

[11] The earliest identified core-formed vessels were found in Northern Syria, near the Orontes River, in excavations during the 1930s and late 1940s. (Shortland 2012: 47; Wooley 1955). Some estimates date these vessels as early as the mid-16th century B.C. (Moorey 1994: 193), but more conservative estimates place them from the late 16th to early 15th centuries in line with estimates for some of the earliest vessels to appear in Mesopotamia and Egypt (Barag 1970: 150, 188).

Core-forming did not allow for the rapid replication of a pattern, since each former was destroyed in order to render the glass vessel usable. This technique was time consuming and difficult, but it was more effective than the alternative, which was to cast a solid glass object in the shape of the vessel and then drill a hollow into the cold glass, as though carving a stone item. Core-forming allowed for closed forms, in which the opening was narrower than the available interior space, but most vessels had tubular interiors because of the limitations of what could be reached through the opening with cutting tools (Tatton-Brown and Andrews 1991: 33-34).

Other vessel shaping techniques included drilling, grinding, and cutting of cold glass; chip casting, in which amorphous glass pieces were placed in a cold mould, then heated until they fused together in the shape of the mould; fusing sections of glass rods in a pattern, or mould-forming, like slumping and pressing. None of these techniques actually required glass to reach a fully molten state, meaning they could be produced in furnaces with temperatures 100 to 150ºC lower than those for gathering molten glass (Stern 1993: 21-22, 27).

When mould-pressing, glass artisans placed a gob of hot glass into a mould designed to shape the vessels exterior and used a wet wooden paddle or plunger to press the glass against the walls of the mould. This can be done in a stationary mould, but experimental archaeology has shown that a mould rotated on a pottery wheel can help evenly distribute the glass (Lierke 1999: 82; Stern 2008: 532). While the experimental work is proof of concept, the actual archaeological and literary record of ancient Rome has neither been able to confirm nor deny that glassworkers of the time actually used a pottery wheel in this way.

Grose even suggests that improvements in glass casting that allowed for efficient production was as responsible, if not more-so, for the initial growth and spread of the glass industry than glassblowing (Grose 1989: 241). The main technique he credits with improving casting and causing growth in the glass industry is sagging – also known as slumping – since it was a quicker and more efficient way of moulding vessels than casting in multi-part moulds. Sagging sped up production because it removed the need to fill in gaps between the multi-part moulds, and also reduced polishing time, because only one surface came into contact with the mould. When creating a vessel through slumping the glassworker only had to heat a lump of glass until it softened, at which point it would settle out to a disc of an even width. The softened form could then be placed over a former and would slump under its own weight to form a vessel as in figure. 1.1 (Fleming 1999: 7; Grose 1989: 194; Stern 2008: 354). A glassworker using such a technique could heat several chunks simultaneously on a furnace shelf and could then place each one on a former to make several vessels at the same time, cutting down time and fuel consumption (Stern 1993: 26). Sagging could be used to produce plain, or mosaic vessels, and as the glass sagged over its mould the glassworker could use tools to add surface details like ribs[12] or trailed decoration (Lierke 1999: 51-55; Lierke 1993; Stern 2008: 534).

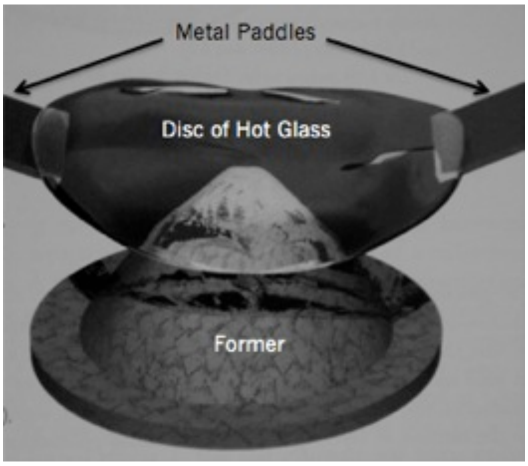

Figure 1.1: Glass disc being sagged over a former to make a bowl (After Fleming 1999: 7 with added labels).

[12] There is some uncertainty over the way in which the ribs on Isings Form 3 pillar-moulded bowls were formed, since what Lierke and Stern argue is only from experimental archaeology, rather than strong archaeological evidence. This is discussed further in case studies below that include this bowl form.

The open shape of the formers used in this method allowed for the glass to be lifted off without destroying the former, but moulded ridges or other decorations were limited because they could prevent the glass from being lifted off. In some cases researchers have found traces of corundum[13] on the surfaces of clay moulds, particularly from 5th and 4th century B.C. Greek sites, including the sculptor Pheidias' workshop in Olympia.[14] Corundum has been interpreted as a separating agent to prevent the hot glass from binding to clay moulds, which it can do when both the glass and clay are hot (Schiering 1991: 19-21; Stern 2008: 524-525).

Cast glass was often time consuming to produce, and the number of steps required[15] are often speculated to have resulted in high fuel and mould manufacturing costs, thus increasing the cost of the end product (Grose 1983: 42). The luxury glass items that appeared in the Roman Republic and Hellenistic world were cast, and the complexity of production may have prevented glass from being cheaply mass-produced and spread to the general public, although closer analysis of the use of cast material may challenge that idea.

The separate categories in most discussions of glass seem to imply that glassblowing simply replaced casting, but the archaeological record shows that casting did not disappear with the advent of blown glass. In fact, cast glass continued to be produced well into the Principate, and Grose pointed out that glass casting actually increased as the glass industry grew in the first century A.D., appearing in a variety of common utilitarian forms and in natural colours (Grose 1989: 241). Grose is in the

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[13] Corundum is an extremely hard aluminium oxide. Sapphire and ruby are varieties of corundum.
[14] The glass moulds in Pheidias' workshop at Olympia were used to create sections of the clothing for the seated Zeus – one of the seven wonders of the ancient world.
[15] Moulds would have had to be made, glass would have to be handled with tools and pressed into a mould, or heated to a liquid state and poured into a multi-part press mould, polished, and for some multi-coloured pieces, each coloured cane would need to be produced in advance, laid out and fused into the other colours before the vessel could even begin to be shaped. (Grose 1983: 42)

minority in suggesting that glass casting was playing a role in spreading glass to those who had not previously been able to afford it, but cast glass is definitely well represented among first century A.D. glass finds, and the relationship between cast and blown glass will be an important subject for examination when determining how the glass industry was changing in this period. Cast glass may have been produced in large quantities in the early first century, but even Grose agrees that it was surpassed by faster and more efficient glassblowing techniques and was in decline by the Flavian era (A.D. 69-96) (Grose 1989: 241-242).

1.2.2.3 Glassblowing

Pressing glass into a mould, sagging it over a former, or forming it around a core, which must be individually crafted and then destroyed in order to scrape it out of the completed glass vessel, limited the production of glass in regard to production rates and possible shapes. Glassblowing, on the other hand, allowed for the rapid production of vessels in almost any size and shape. Even a single glassblower could produce large quantities of vessels for ordinary use in a short period of time making glass available to larger numbers of people than in any time before the discovery that glass could be inflated. For example, modern glassblowers using the same techniques as Roman glassblowers can produce an average of 100 plain utilitarian vessels per day (Stern 2004: 102).

Free-blowing was the first glassblowing technique developed. It is highly versatile and became the prominent method of glass production throughout the rest of the Roman period, eclipsing both mould-blowing and glass-casting (Isings 1957: 14). Free-blown glass can achieve almost any shape by swinging the paraison on the end of the blowpipe and rolling it on a marvering table or pinching it with tools (Price and Cottam 1998: 13). With this technique vessels can reach whatever size the blowpipe and the glassblower can support if there is enough raw glass. Most of the earliest blown vessels were just tiny unguent bottles and small bowls with pinched rims and trailed decorations, but this technology revolutionised the glass industry, and most scholars credit it with kick-starting the Italian glass industry despite the fact that most of the early Roman glass is cast rather than blown (Berlin and Herbert 2012; Klein and Lloyd 1984: 24).

The technique required to blow glass, while not necessarily easy to perfect, is, at least in theory, quite simple. Hot glass can be gathered on the end of a blowpipe either in the form of preheated chunks,[16,17] which does have literary support from a Greek poem on an Egyptian papyrus that mentions snatching up 'a chunk of bright [glass]' and goes on to describe inflating a paraison (Coles (trans.) 1983: 59, No. 3536), or as a thick liquid similar to honey in texture (Stern 2012: 33; Stern 2008: 524). The glass worker then blows through the pipe, and the air pressure expands the paraison on the other end of the pipe. In order to keep the hot glass from sagging in the direction of gravity, the glass blower needs to rotate the pipe. The craftsman can also extend height of the vessel in progress by swinging the blowpipe, and can shape it further by rolling it on a flat surface or 'marvering table.' Once the vessel reaches the desired shape and cools enough to hold its form, it is removed from the blowpipe to have the rim finished, and can have handles and/or other decoration added.

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[16] Stern and Amrein argue for chunk-blowing as the dominant early method based on the image of squat blowpipes on clay lamps from Asseria (modern Benovac, Croatia) from Ferrara, Italy, and from Skolarice, near Koper, Slovenia (Fig 1.5) (Amrein 2001: 165; Stern 2012: 37, 41), and thin-walled bottles from western Turkey, and Aquileia, which have one side made from transparent blue glass, and the other side made from transparent yellow glass. The Colours are not overlaid, but both run from the rim downwards, dividing the vessel in half. It is impossible to manipulate molten glass in such a way as to cover only half the tip of the blowpipe, and then to gather another colour on the other half. (Amrein 2001: 24; Stern 2012:33-36; Stern 2004: 94; Stern 1999b: 446-450). Stern also argues that the higher temperatures required for molten glass blowing were only easy to reach after glassworkers moved to the West where there were more available forests for fuel (Stern 1999b: 451, 454).

[17] Chunks of glass could be pre-heated on a ledge near the top of furnaces as shown in a reconstruction at Avenches, based on the images on clay lamps. This reconstruction is plausible, but since Roman glass furnaces are known only from footprints (Taylor and Hill 2008: 249), the superstructure is largely theoretical and based on experimentation. Without finding a ledge, its presence and use cannot be confirmed, and depictions in other media cannot always be taken as fact.

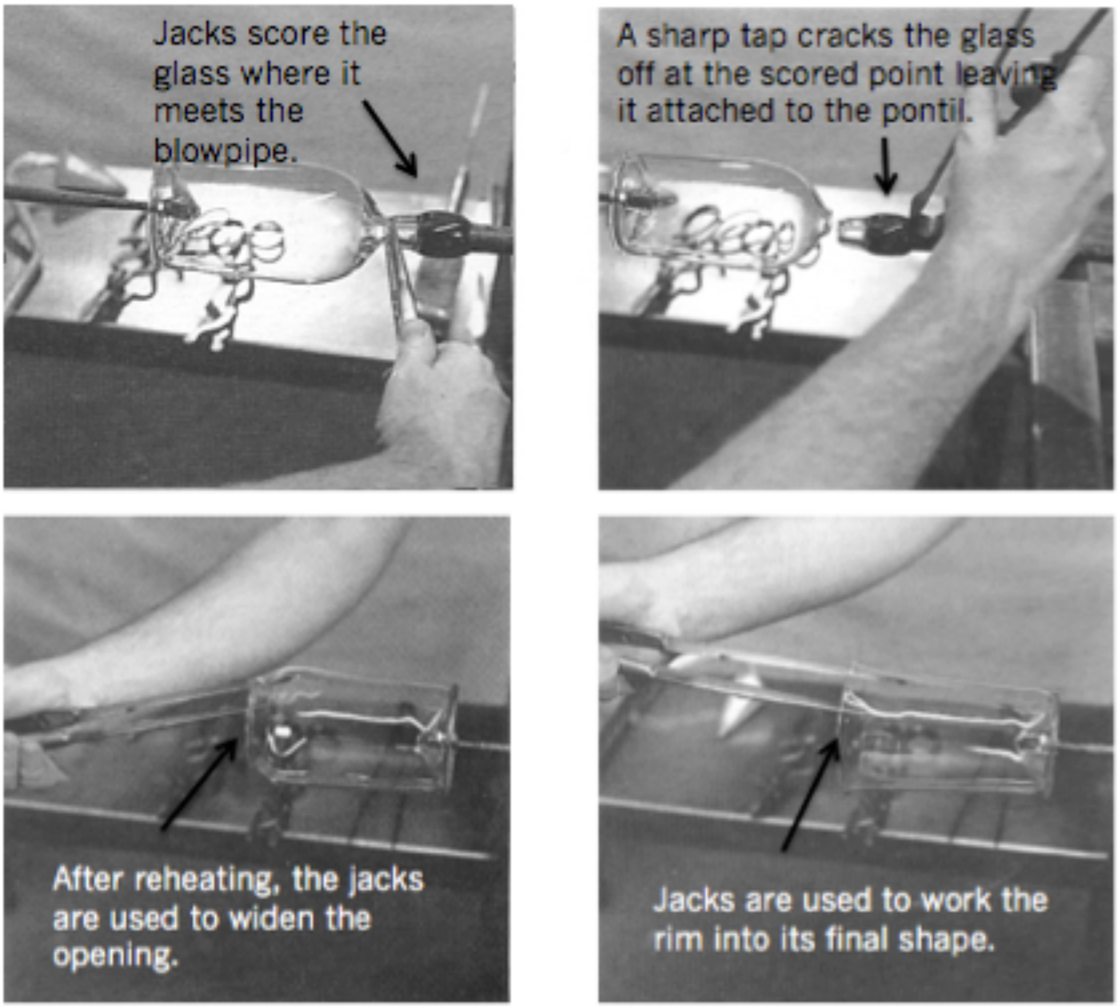

Figure 1.2 Removing a vessel from the blowpipe and finishing a rim. (After Tait 1991: 225 with added labels).

Practice and skill is necessary to ensure that the vessel is kept at a workable temperature throughout the blowing process, and the glassblower must be able to regulate the cooling process to prevent stress fractures that appear if the surface of the glass cools quicker than the interior. In Roman times, a variety of methods were used to slow the cooling process, ranging from a chamber attached to the furnace that received indirect heat from the fire, to submerging the completed object in piles of ash and olive pits, which help to retain heat (May 1904: 43; Price 2005: 172; Stern 2008: 524-525). Skill and a good understanding of how glass will move at different levels of viscosity was also necessary to ensure the correct amount of shaping from the movements of the blowpipe. Shaping a vessel with rolling and swinging movements is often referred to as ‘free-blowing,’ but glass could also be blown inside a mould, which will be addressed below.

There were a variety of different types of decoration that could be added to free-blown vessels at different stages of production, which often come up in catalogues of vessels or in handbooks of artistic style or glass analysis such as Price and Cottam’s 1998 handbook on Romano-British glass. Decorations like blobs, or chips of another colour, lumps, and trails were made with hot glass while the vessel was still being heated and formed, as was tooling, and folding. Handles were added while the vessel was still being heated, but after the body was fully formed. After a vessel cooled it could be adorned with cut decoration, or enamelled.[18] Enamelled glass was, however, quite rare in the Roman world (Price and Cottam 1998: 31-34).

1.2.2.3.1 Mould-Blowing

While free-blowing was the first incarnation of glassblowing and continued to be the most common method of glassblowing throughout the Roman period and beyond, mould-blowing was a key early development that had its heyday in the first century A.D. and is responsible for many of the most famous, and some of the most widely traded early Roman vessels. Mould-blowing allowed for detailed surface decoration, and for rapid, uniform mass-production of vessels. The technique involved inserting the paraison into a multi-part mould and then inflating it until it took on the shape of the mould. The mould would then be removed and the vessel could be finished using the same finishing techniques as free-blowing.

[18] To enamel glass, powdered glass was painted on to the cooled vessel with a binding agent, and then the vessel was re-heated to fuse the enamel.

Nobody knows exactly where, or when mould-blowing began but it was definitely an active practice in the second quarter of the first century A.D. The earliest piece of mould-blown glass was found in possible Augustan contexts at Magdalensberg, in Austria, but was of a style commonly attributed to eastern glassblowers and is frequently attributed to Ennion, the most well-known decorative glassblower of the first century who is believed to have come from Sidon, in the Levant (Stern 2008: 539; Stern 2004: 113). Decorative mould-blown tableware continued to be popular up until the early Flavian period (Price 1991: 64). Most of the decoration falls into five themes: vessels, masks, fruit, mixed symbols (*e.g.* spikes, gadroons, lozenges, and floral designs), and birds. There are many high quality examples in opaque, glossy, white glass, or opaque light blue, but there were also many on translucent to transparent coloured glass with the most common colour being dark blue (Stern 1995: 74-75). Amber and light green were also fairly common. Other common features were phrases such as “seize the victory” (Stern 1995: 95), “your good health” (Klein and Lloyd 1984: 29), or a Semitic blessing formula “may the buyer be remembered” (Tatton-Brown 1991: 70).

Most sources agree that mould-blowing was an Eastern development and it was Syro-Palestinian craftsmen who exported the technique to Italy and the West. In the Augustan period and into the first century A.D., popular tastes in tableware began to lean toward decorative relief, and while glass workers could imitate the intricate decorations of clay and metal-ware with cameo carved vessels, this was time consuming and inefficient. Each item would also be unique so it would be difficult to produce sets. The development and spread of mould-blowing allowed glassworkers to compete with the Northern Italian pottery making centres that were producing a wide range of mould-cast tableware (Fleming 1999: 37). Many of the earliest mould-blown vessels produced in the West followed the styles of the Levant, but western styles did slowly develop as the knowledge of mould-blowing spread to western artisans. By the third quarter of the first century, one of the most fashionable styles was a simple transparent beaker with pointed oval bosses in high relief (Stern 2004: 113; Tatton-Brown 1991: 74). Numerous other elaborate designs became popular at the height of decorative mould blowing including a type of perfume or oil flask shaped like dates, and another designed to look like a bunch of grapes; beakers similar in shape to the bossed beakers, but with panels depicting representations of the seasons or figures from Greek mythology between garlands or set in niches; and small, usually coloured, bottles with long necks and bodies shaped like two heads facing opposite directions like the god Janus[19] (Tatton-Brown 1991: 73-74).

By the middle of the first century one of the most distinctly western forms of decorative mould-blown vessels appeared. These were the chariot and gladiator cups, or as they are sometimes collectively called, 'sport cups.' Their popularity lasted between about A.D. 45 and 80, and they were inscribed in Latin rather than in Greek, which was the language on most decorative wares (Fleming 1999: 40). Sport cups appear to have been produced in the West, for a western market, and this style stands in stark contrast to the peaceful Sidonian style of decoration, which is focused on plants and geometric shapes (Corning Museum of Glass 1957: 59-60). They have been found in contexts throughout the West, including Britain, France, Switzerland, Italy, Spain, and on Corsica (Price 1974: 66-69; Tatton-Brown 1991: 72). Sport cups depict amphitheatres, chariot races, or gladiators in combat, and they frequently have the names of the gladiators or charioteers on them (Tatton-Brown 1991: 72). Price says that it is generally assumed that these cups come from Rhône valley, or Swiss workshops, but

[19] Both 'head bottles' and the date flasks have been discovered at Pompeii and Herculaneum clearly dating these forms before A.D. 79 (Tatton-Brown 1991: 73-74).

there is also possible evidence for production on Corsica, where fragments of a two-part mould have been found between Mariana and Borgo (Price 1974: 66; Tatton-Brown 1991: 72). There is no production evidence to say definitively that these mould fragments were used for glass, but the frieze fits the sport cup genre, and Price argues that ceramics would not require a multi-part mould since it would shrink during firing and pull itself free of the mould. However, she is hesitant to state definitively that the Corsica mould fragments were for glass (Price 1974: 66). Donald Harden recorded 43 chariot cups and 32 gladiator cups known to still exist in 1953, covering a wide range of sites across the Western Empire (Corning Museum of Glass 1957: 59). Five gladiator cups, one chariot cup, one combined chariot and gladiator cup, and one cup that depicts either gladiators or other athletes, come from Spain, though none were found in datable contexts. The styles are analogous to Neronian and Flavian examples, and the gladiator cups do bear the names of historical, and/or literary gladiators. Names like Spiculus and Petraites appear on some of these cups. Petraites is a gladiator in Petronius' *Satyricon*. Spiculus is known to have fought in the reign of Nero, and Petronius died in A.D. 66 so these cups are almost certainly Neronian. Price's discussion of these vessels shows that they come from a variety of locations around Spain including Seville, Barcelona, and the vicinity of Mataró, so they were not just representative of something uncommon or a single person's collection. They were something that was popular in society, at least among those who could afford decorative glass (Price 1974: 69-72).

Production of decorative mould-blown wares began to decline from the mid-Flavian period but mould-blowing, as a production method, did not vanish. In Italy and the West mould-blowing was used to mass-produce smooth-sided, utilitarian bottles and household containers (Stern 2004: 80). Utilitarian prismatic bottles, which were being produced at least by A.D. 40 (Tatton-Brown 1991: 74), could be rapidly produced from simple moulds; the uniformity of such vessels making them perfect for fitting into crates for shipping and storage. They started off small, but evolved into large storage vessels, which flooded the market in the third quarter of the first century. Not only were they easy to package, but their uniformity also allowed for controls on the volume of the contents. Moulded bases were excellent for facilitating brand recognition and providing a guarantee of quality or volume (Stern 2004: 114). They were primarily used to transport liquids, and were ideal for this role because they were easier to inspect and clean than their ceramic counterparts. They also imparted no scent on the contents (Tatton-Brown 1991: 74).

Several sources comment on the materials from which the moulds were made, but most of these are just general comments based on assumptions or a few examples. Most scholars who discuss mould-blowing say that the moulds were made of metal, wood, plaster, ceramic, or even wax, and Fleming states that most moulds were themselves casts of pre-sculpted wooden, plaster, clay, or wax models, but there is little other discussion and very few examples of definite glass moulds exist (Fleming 1999: 38; Klein and Lloyd 1984: 11; Stern 2004: 113). Many of the arguments are based on hypothetical statements about what could have worked to produce the forms seen in glass, or on modern analogues. There is almost no discussion of the reasons for using different materials, or the evidence for vessels that were produced in certain types of moulds.

Francois van den Dries (2007) is an exception. He focuses specifically on the material and techniques used with early-Imperial glass moulds. He addresses the problems of discussing moulds in the relative absence of surviving examples. He includes a table of all the moulds known up to the time he was writing for his 2007 publication. The list is made up of only 33 fragments with an addendum of nine additional moulds that he learned of after the article was ready for publication. This gives us an entire corpus of 42 examples from the whole of the Roman world.

It was certainly possible to use low-temperature unfired ceramics for mould-pressed glass, because such moulds have been found in the workshop of Pheidias at Olympia. There are no known examples of this from the Roman period, but we cannot eliminate the possibility that the technique continued to be known and used (van den Dries 2007: 26).

There are very few glass vessels that can definitely be attributed to metal moulds. In fact, there is only one first century example of a glass vessel that clearly appears to have been made in a metal mould. This is a hexagonal bottle in the Victoria and Albert Museum in London (8135) (van den Dries 2007: 27-28). There is speculation that Ennion used metal moulds, due to the assumption that he could not have achieved such clear images with other materials (Price 1991: 58). Van den Dries questions this based on the fact that metal moulds usually leave cooling marks or rings on the surface of glass items that are hotter than the metal when they come into contact with one another, and Roman vessels rarely show cooling marks.

The record of known moulds suggests stone was the most common mould material, although ceramic moulds are well represented, particularly for 4-12 sided prismatic bottles (van den Dries 2007: 30). Vessels produced in ceramic moulds are sometimes easier to identify than those produced by other types of moulds due to specks of clay from the mould actually sticking to the glass, resulting in surface inclusions.[20]

Based on the number of known mould fragments, and the number of known mould-blown items, van den Dries estimates that moulds were produced in the thousands, if not millions. Frequent mould making would have been especially

[20] Surface inclusions from moulds have been noted on the Colchester circus cup, in the British Museum (AN52151001) and a Hercules 'club beaker' in the Valkhof Museum in Nijmegen (van den Dries 2007: 27-28).

important in workshops producing decorative wares. A simple stone mould used for undecorated bottles could last a long time, but clay moulds used for more intricate designs would deteriorate and need to be replaced. The lifespan of such moulds must have been fairly limited as there are very limited numbers of vessels that can be attributed, with any kind of confidence, to the same mould (van den Dries 2007: 30). If the glassblower wanted to continue using the design he would then have to make a new mould from an archetype or from an existing vessel. Stern notes that this would lead to a decline in the size of a vessel and quality of the decoration over the run of a design since the clay mould made from a vessel would shrink when fired (Stern 1995: 48). Van den Dries notes that other scholars have recognised that clay moulds made from a vessel lead to a decline in the size of subsequent vessels, but thinks that few writers fully express, or consider the implications of this, and how serious the shrinkage is. He says that just in drying, clay shrinks by about 10 per cent and shrinks a few per cent further upon firing. Within five generations the vessel produced by a mould would be about half the size of the original, and the decoration could be greatly obscured (van den Dries 2007: 31).

In his discussion of stone moulds, van den Dries states that, despite their majority in the list of known mould fragments, they are likely under-represented in the archaeological record. Particularly in the case of stone moulds for smooth-sided prismatic bottles, the mould fragments could easily be mistaken for building debris and be overlooked. Most of the stone mould fragments that have been identified are base moulds, because they have more distinct features than the smooth wall pieces, of which only two are known (van den Dries 2007: 31).

While Stern claims that most moulds that were not clay were plaster (Stern 2004: 113), van den Dries points out that most plaster in the Roman period would not have held up well as a mould, as good gypsum was not yet being produced, so plaster moulds would not have been used in first-century glass working (van den Dries 2007: 34).

1.2.2.4 Glass Workers

Several sources comment on the people who were producing Roman glass and the organization of the glass industry. There is no real evidence, before the first century A.D., identifying glassworkers. After that point we can find makers' names, or at least workshop names moulded on glass vessels and we know the names of both male and female glassworkers (Stern 2008: 520). Many of the earliest signatures come on decorative mould-blown vessels. These bear Semitic names, in Greek script, which correspond to the region where glassblowing was developed. The first evidence we have of glassworkers in Italy corresponds to the same time at which Arretine potteries were being established and staffed by slaves or freedmen with Greek or eastern names. There is, as of yet, no sign of local production in the heartland of Arretine pottery production, but that did not discourage the trade of glass in that area. At least one third of the over 100 Roman sites identified in surveys of the lower Modena plain have uncovered over 1300 glass fragments (Arletti *et al*. 2005: 80).

Glass scholars have often found it useful to look at the makers' marks on glass to trace the identity of glassworkers and the distribution of their works. Several names are known from surviving first-century A.D. vessels or vessel fragments including Iason; Meges; Aristeas; Artas, Aristoon, Philippos, Neikoon, and Eirenaios (who added 'Sidonian' or 'of Sidon' to their signatures); and the most famous and well represented: Ennion. There is some suggestion that those who added the toponymic phrase were working outside of their hometown, or were making items specifically for export. The locations of Artas finds led Stern to suggest that he may have actually migrated to Rome and produced his wares there (Stern 2004: 81; Stern 1995: 69). Artas' cups also had blue handles speckled with opaque white glass, which is a style strongly associated with Italian workshops (Tatton-Brown 1991: 70).

Ennion has over thirty known vessels attributed to him either by his signature or, in the case of some fragmentary vessels, by the style and quality of the decoration. His style and technique is often assumed to be Sidonian and his name, which appears to be a Hellenised Semitic name rather than a Greek or Latin name, would also suggest that he is of eastern origin (Stern 1995: 69-71). The distribution of his work has led some, like Donald Harden, to suggest that he migrated to Northern Italy, but this theory is highly contested. He argued that since all but two of the thirteen cups that were known when he was writing in 1935 were found in Northern Italy, Ennion must have migrated there and set up his workshop. Harden admitted that Ennion's jugs and *amphoriskoi* were found in the Eastern Mediterranean and a bowl was actually found in Sidon, but he thought that those represented his early experimentations with style and that he settled in to his trademark cup design after moving to Italy (Harden 1935: 164-169). More recent scholars have doubted this theory of Ennion's migration, because, while it is possible, there is no convincing evidence for such a move. Ennion never changed his signature to include a toponymic phrase as others who migrated away from home did and, unlike several others who appear to have operated out of Italy or the West he did not sign his works in the Latin alphabet. Aristoon, Artas, and Philippos all produced works signed in Greek and Latin (Stern 1995: 68). Other works of Ennion have since been found on the Black Sea complicating the Italian argument and again showing the challenges faced in glass distribution studies (Tatton-Brown 1991: 70-72). Stern leans toward the opinion that Ennion simply had a broad trade network. After all, his works are not just found in the eastern Mediterranean and Northern Italy/Austria; they have also been found in Gaul and as far west as Cadiz, Spain and Morocco. This wide spread, according to Stern, could simply indicate a glassblower who was also a shrewd businessman who understood long-distance trade and had the right trading partners. His mould-blown vessels are also among the highest quality decorative mould-blown tableware of the period with clear, precise, shallow relief designs and, as such, may have been sought after by wealthy Romans who owned land in Italy and elsewhere. Additionally, if he was, as many including Harden suspected, from Sidon then he would have had access to extensive overseas trade for which the city was known. Another set of possibilities is that Ennion traded some of his moulds with other workshops rather than moving himself (Stern 1995: 71).

Harden discusses the work of other Syro-Palestinian decorative mould-blowers who were operating around the time of Ennion and discusses the various types of inscriptions that appeared on these vessels, but does not go into the same speculation about their lives and migrations as he does with Ennion (Harden 1935: 169-183). This is because Ennion had by far the largest distribution and volume of known works, but there is very little insight into who the other producers were other than what their names and other writing on the vessels can tell us. The use of the Semitic blessing formula μνήσθη ὁ ἀγοράσας 'may the buyer be remembered,' combined with the fact that Iason and Meges were common Jewish names in the first century A.D. led Fleming to speculate that these two, at least, might have been Jewish. The signature of Aristeas, which is in *tabulae ansatae* on one of his vessels, and his decorative style, has led to speculation that he was a follower or co-worker of Ennion. His signature also proclaims him to be a Cypriot (Fleming 1999: 39).

Other than these few examples there is very little we can tell about the lives and identities of early Roman glassblowers. In fact, Price points out that even this little bit of information is not necessarily telling us about the glassblower. We cannot say for sure that all of these signatures belonged to the actual glassblower, or to a workshop owner, archetype maker, or mould maker, and we do not know how much, or in which cases these roles overlapped. Price also notes that first century Arretine, Gaulish Samian, and Aco and Sarius vessels were stamped too, but the marks on these are generally accepted to advertise the factory owner rather than those of a worker (Price 1991: 58).

It appears that both the glass and ceramics industries were stimulated by an influx of Eastern people under the Augustan Peace (Grose 1989: 242). While it is generally assumed that people involved in the glass industry were of very low status[21] it is uncertain what their status actually was. Stern refers to glassblowers as *banausoi* or ‘furnace’ workers, and says they were the lowest level of free society (Stern 2008: 78), and Fleming says that most craftsmen were slaves and that their skills were exploited but not respected or admired. He goes on to say that glass working, like most other crafts, was never key to the Roman economy, which, if the traditional scholarly model is to be accepted, was based on land ownership (Fleming 1999: vii). It is not even certain what role in production the names in the makers’ marks represent. There remains a question of whether the signatures represent the workers themselves or the owners of the workshop. The fact that many of the early names in the industry are not Roman names suggests that they represent those actually involved in the production, and many of these individuals were the same people who came from the East with knowledge of the industry, to take advantage of the peace and economic boom of the early Empire (Stern 2004: 80). Soon after, Roman names began appearing on moulded vessels. There are approximately 130 known names of which two Latin names are clearly female

[21] Supported by statements from Cicero (*De Officiis* 1.42) and others of senatorial rank that described manual labour as ‘below the dignity of free men’ (Stern 2004: 37).

(Sentia Secunda and Ennia Fortuna), and one Greek name (Νεικαις) is most likely female, but could be an odd spelling of a male name.[22] Some still argue that the names on glassware, or in some cases just the female names represent shop owners rather than the people who actually worked the glass, but many of the signatures do include the phrases *fecit* or one of ἐποίησεν or ἐποίει. These phrases mean ‘made it’ or ‘made me’ and suggest that the person represented actually did have a hand in the production of the vessel. In the case of Sentia Secunda, she even included the abbreviation *vitr[earia]* meaning ‘glassmaker’ in her stamp (Stern 2004: 115-116). One other factor to consider, in determining the role of the individual named on vessels is the case of the name. If a name appears in the genitive it may indicate that the vessel is from the workshop “of so-and-so,” where a name in the nominative, such as Sentia Secunda more likely refers to the glassworker (Stern 1999: 469).

1.2.2.5 Workshops

As was mentioned above, when discussing the methods of glass production, sources generally agree that the majority of glassmaking and glass working was done in separate workshops for much of the Roman period. The actual combination and fusion of components into raw glass was often carried out in primary workshops near the sources of raw materials (Fleming 1997: 10) and then shipped out as ingots to secondary workshops, which then produced the glass for their own local markets. This enabled the glass industry to meet regional needs and avoid breakage during shipping, and made production possible since not all parts of the Empire had suitable materials for making glass. Suitable sands that contained both silica and lime were not readily found

[22] Some have argued that Νεικαις is a short form of the male names Νεικαιος, or Νεικαιας with metathesis of the α and ι, but Stern argues that the –ις ending strongly suggests that it is feminine. Stern also points out that the female form of the name has been found on funerary inscriptions from Cyrenaica (Stern 1997: 130).

in all regions and were most prominent along coastal regions where seashells were mixed in with the sands. More importantly, in the early Empire, glassmakers of the Roman period preferred a sodium flux like natron to a plant ash flux and this was a much rarer commodity. As a result, the bulk of Early Roman raw glass was produced in Egypt or along the Syro-Palestinian coast, with major raw glass production in western Empire sites such as Köln, Trier, Mainz and the Hambach Forrest only developing in the fourth century A. D. (Wedepohl *et al* 2003: 56-58). These regions not only provided the necessary sea-sands, and in the case of Egypt the natron, but provided easy access to shipping, which aided in the acquisition of any materials not present and in the exportation of the finished glass.

We know that glass ingots were shipped over long distances in the Roman period because examples have been found in shipwrecks, including about 100 kilograms of glass ingots from a late first-century wreck near Mljet, an island off the coast of Croatia (Price 2005: 168). Location, even within the production regions, is something that researchers found to have been important to ancient glassmakers. Primary workshops were often found on wooded hillsides near the coast to take advantage of the fuel source and because sea breezes could create ample furnace drafts to raise the fire temperature (Fleming 1999: 52; Gorin-Rosen 1995).

There was a difference in the resources and setup required to produce glass and to work it, as was mentioned above. The furnaces, as with those discovered in 1992 at Hadera, Israel, had to be dug into the soil and were lined with mud bricks (Gorin-Rosen 2000: 52). These massive furnaces would then be completely disassembled to collect the glass once the firing was complete. This frequently results in only furnace floors or waste material being left to identify the site, except in the case of a failed melt such as the one at Bet She'Arim (Fischer 2008: 20).

Secondary workshops did not require such a massive investment in infrastructure, or fuel. Roman cast glass, and even most of the early blown-glass was made from this soft, but non-liquid state, which required lower temperatures than initial glass production. Since a glassworker only produced one glass piece at a time, secondary workshops could have much smaller furnaces, which required much less fuel. Most of the glass-working furnaces that have been discovered are less than one metre in diameter (Price 2005: 170; Taylor and Hill 2008: 249-251). As a result of the lower fuel and space requirement, glassworkers could set up shop almost anywhere that they could find a market for their wares. Small furnaces were not as complicated to set up as primary production furnaces, and glassworkers did not require a huge range of complicated tools, allowing glassworkers a degree of mobility. They could follow the army or move around to various towns. Necessary equipment included shears, tongs, and pincers (Fig 1.3), a blowpipe, and possibly some ingots. As glass working technology advanced, and cullet recycling became common practise, a glassblower could also collect broken wares and fashion items from them rather than purchasing ingots. Fleming estimates that by the latter half of the first century A.D., glassblowers had expanded far enough throughout the Empire that most everyday glass needs would have been met by local production (Fleming 1999: 53-54).

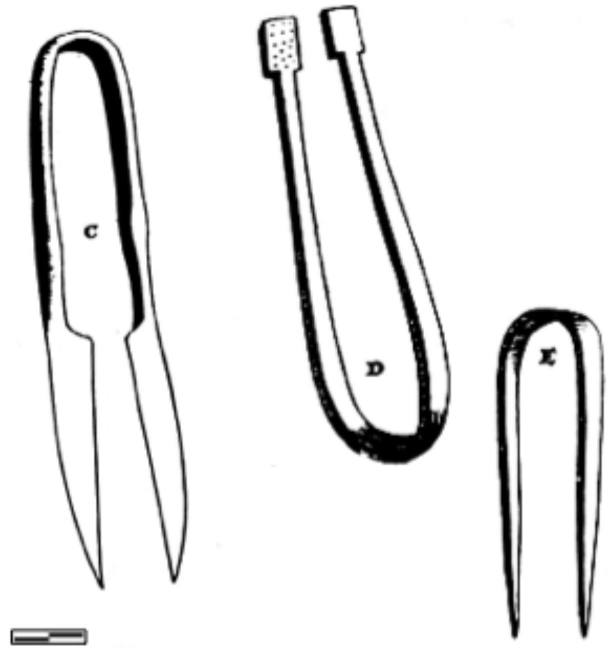

Figure 1.3: "Jacks": Shears and tongs used by glassworkers to shape and finish vessels, and remove them from blowpipes (After Douglas and Frank 1972: 9).

It is not known exactly when cullet began to be collected for recycling on a regular basis, but it seems likely that it only began on a large scale in the mid-to-late first century A.D. The first references of cullet collection come from the Flavian writers Juvenal, Martial, and Statius (Juvenal *Sat.* 5.47-48; Martial *Ep.* 1.41.3-5 and 10.3.3-4; Statius *Silv.* 1.6.73-74), and it is also around this period that strongly coloured glass fell out of popularity in favour of clear, or natural coloured glass. This change follows logically from organised glass recycling, because one can readily blend the glass from many clear or naturally coloured vessels, whereas if one melts strongly coloured vessels together it produces a muddy colour. The use of cullet would lower production costs, by cutting down the need to import raw glass. There are a few attested cases of cullet being transported by sea, but for the most part, it would be gathered locally (Price 2005: 169).

In order to facilitate sales, glassworkers often set up shops in areas where other industries that required glass were situated. In Puteoli, for instance, we know from epigraphic evidence that glassblowers were working in the same district as frankincense dealers, and were likely providing the containers for the frankincense. The inscription reads *Regio clivi vitrari sive vici turari* or “the quarter of the glassworkers also known as the quarter of the frankincense dealers” (Stern 2004: 104; ILS 1224b). Glassworkers often made vessels specifically for the items that were sold in them, and even heat-sealed the vessel once the product was inserted. For example there are a series of small bird shaped containers that were filled through the hollow tail, which was then sealed shut by the glassworker. The tail was then broken off to access the contents after sale (Tatton-Brown 1991: 66).

Relatively few glass workshops have been definitively identified despite the significance of glass and its broad distribution in Roman society. This largely has to do with the minimal nature of a glass workshop’s setup and the basic tools required. In order to identify a glass workshop and clearly define it from the workshop of other fire-based industries one must identify waste material, which is often not left behind due to the recyclable nature of glass. As far as can be determined, there were fewer glass workshops than other fire-based workshops, such as potteries and smithies, in the Roman Empire. If one looks at Switzerland where 23 glass workshops have been identified, that number only makes up around six per cent of fire-based workshops in the country. There are 87 workshops producing copper alloys, 143 known iron-working shops, and at least 116 pottery workshops (Stern 2008: 541). A big reason for the difference in the numbers could be the organization and setup of the different types of workshops. Glass workshops, unlike some potteries, were not large establishments with many slaves carrying out multiple stages of production on many vessels, all at the same time. In a glass workshop each glassblower needed his or her own furnace port to keep reheating the glass until the final form of the vessel was reached. In Roman times, this would have meant having a furnace for each worker, since the pyro technology of the time did not allow for furnaces that could maintain the necessary heat with multiple working ports. We do not, in fact, have any evidence for multiple-port glass furnaces until a 15th century drawing that is now stored in the Vatican library (Fig. 1.4) (Stern 2008: 541).

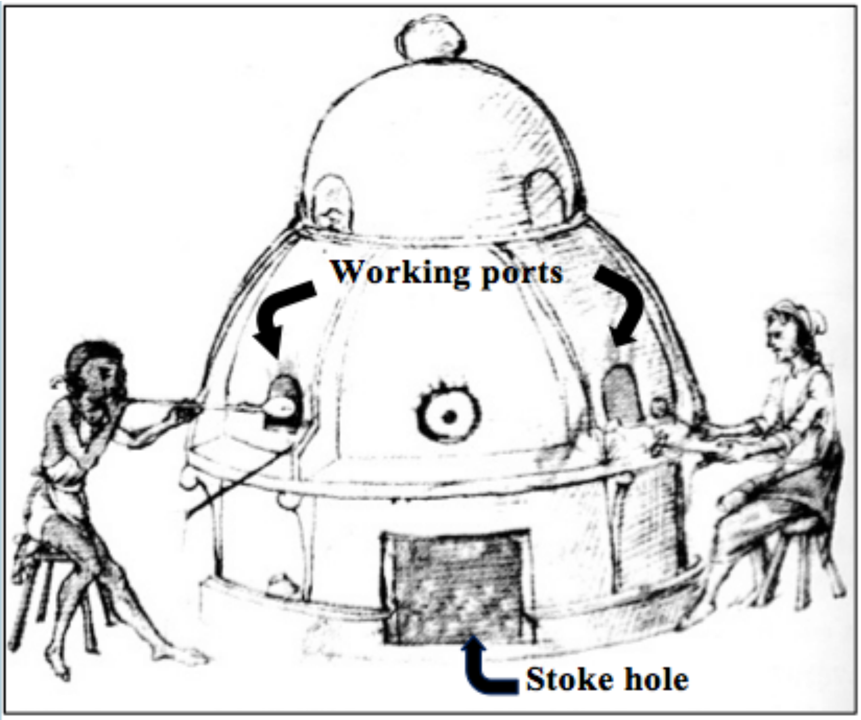

Figure 1.4: 15th Century glassblowing furnace (After Stern 2002: 160 with added labels).

The majority of glass workshops were likely small single-furnace operations. Even in the few cases where multiple furnaces have been discovered, it is not certain that they would have been used simultaneously. As seen at modern workshops using primitive furnaces similar to those used by Roman-era glassblowers, a furnace has to be left for about 24 hours after use in order to cool enough to clean out the ash and collect any dropped glass material. Having two furnaces can allow a single glassblower to work everyday, rather than only on alternating days. These analogous modern workshops in Cairo and Herat, Afghanistan suggest that a single glassblower in Roman times would have been able to produce an average of 100 standard sized utilitarian vessels per day (Stern 2008: 541).

More than 70 Roman glass-working sites have been identified in France, and more than 20 in Britain, often with evidence of a furnace. Unless the site was abandoned or destroyed suddenly, preventing the workers from taking raw glass, cullet, and finished products with them, the only finds that would remain to identify the place as a glass workshop would be glass droplets, and a small furnace, which could be mistaken for an oven or small kiln. Generally, only the ground plan and substructures of furnaces survive, showing that they were mostly circular, 0.4-1 meter in diameter, and had a single flue. For more information about the structure of furnaces, the only evidence comes from contemporary images, such as those of glassworkers represented on ceramic lamps from Asseria, Croatia and Skolarice-Krizice, Slovenia, which show a domed structure with a sloping platform at one side for marvering (Fig.1.5). A second-century terracotta group in the British Museum depicts a glass furnace as a tall tapering structure with separate chambers for firing and melting (Price 2005: 170; Stern 2008: 536-537). The actual blowing area of a workshop could be quite small and tucked away in a corner, leaving the majority of the space for storing fuel, un-worked glass, and cooling vessels. Some glass-workshops were built of thick clay bricks that helped insulate and control the cooling of vessels. Others had special chambers adjacent to the furnace for annealing (May 1904: 43; Neuburg 1962: 66). At Mancetter, there was one furnace that had been relined several times, whereas some other sites like Avenches and Lyons have revealed groups of furnaces close together; possibly to serve as replacements for those with worn linings (Price 2005: 171-172).

Figure 1.5: Clay lamp from Skolarice, Slovenia (After Stern 2008: 537 with added scale).

1.2.3 Treatment of Glass in Archaeological Literature

Glass is not uncommon in literature on Roman archaeology, but, for the most part, the industry is still not addressed fully. Glass as a material is often only covered in a cursory fashion, and very little actually focuses on the use and consumption of glass vessels. The bulk of commentary on early-imperial Roman glass is descriptive, or about manufacture. The importance of glassblowing is regularly the subject of comment, but scholars do little to qualify their statements other than citing examples of where glass is found indicating that it was indeed used across the Empire. Additionally, there is some discussion of signed pieces, which can be used to trace a single glassworker's distribution. The majority of this discussion is focused on production methods, which have been discussed above (Fleming: 1999; Fleming 1997; Grose 1991; Grose 1983; Harden 1881; Harden 1969; Isings 1957; Stern 2008; Stern 2004; Stern 2002).

The main categories are *cast* glass, which includes virtually everything that is not blown, whether it is sagged, core-formed, or even poured into a mould (this last method usually post-dates this period of study); *mould-blown* glass, and *free-blown* glass. The layout of many glass histories almost makes it appear that glass production was a simple progression from core-forming, to mould-pressing, to slumping, and then to glassblowing, with little to no overlap. Inclusion of the archaeological and historical background, however, immediately shows that there was far more fluidity and overlap in the use of different production types with new techniques producing new vessel forms, but with a strong continuation of older techniques for more traditional vessels.

Harden (1971, 1969, 1968) has traced the distribution of signed works of first-century A.D. mould blowers, and many have tried to catalogue styles or understand the artistic tastes of different periods. Authors have discussed what forms of glass fit certain eras and regions, but there is little discussion of the industry as a whole. Most discussion of glass movements and trade comes indirectly through descriptions of types of glass, and most of these are in catalogues of items from certain sites or collections (Smith 1949). The minimal treatment of glass in trade comes not from a desire to omit glass, but from its relative homogeneity in both forms and chemical composition. With pottery, local wares and imports can be compared by studying the fabric and the form, but this is very difficult to do with glass (Orton and Hughes 2013: 206; Pitts 2005). The fabrics of glass vessels can look the same even if they come from vastly different sources, the raw material source does not identify the vessel production location, and, in the first century A.D., there was very little in the way of regionally diverse forms, which would have eased the tracing of vessels back to their production centre.

Few people have attempted to create strong form chronologies, the like of which exist in ceramic studies. In fact the most significant work published on glass in this field is Isings' 1957 Ph.D. project, which compiles all the forms known to her with information on identifying features, date ranges, and the locations of known dated finds for each form. Her work has still not been surpassed, although people have experimented with new identification systems, and forms not covered in Isings are known to exist. Isings Form numbering is still the standard numbering used in Roman glass studies and this makes her work impossible to ignore. It covers four centuries of Roman glass using evidence from excavations throughout the Empire. Her work on identifying forms is incredibly useful, and while limited, her inclusion of numerous dated samples of each form helps to direct further investigation into any type of Roman glass vessel. Isings gives a good brief history of the rise of Roman glass use and known production centres, but her introduction to glass in the Roman world, and particularly her introduction to the chapter on first-century glass, shows a strong bias toward the old idea that cast glass was inherently costly and luxurious, where blown glass was cheap and mostly utilitarian (Isings 1957: 1-15). She says that the finest vessels were, at first, all made through old casting techniques, and that a large amount of early Roman cast glass was used to imitate high-value stone-ware like fluorospar murine ware (Isings 1957: 15). Isings (1957: 1) places blown-glass as "within the means of almost everyone," and argues that even though glass production spread to Italy, most mould-pressed glass still came from the East. Considering that chemically sourcing glass only locates the raw glass production site, it is impossible to prove that cast vessels only came from the East as even if the glass originates there, the vessel may not. Furthermore, the strong presence of cast glass in the West throughout the first century, including utilitarian forms and naturally coloured, non-decorative pieces that are strictly present on sites to be used (Cool and Baxter 1999: 85) would seem to indicate that people were not just importing it as a luxury item, but were using it widely. There is no reason to believe that glass workers did not produce cast utilitarian wares in the West, near to their market, just as with blown wares. Importing glass goods would have made them more costly, and it is easier to make fragile materials close to their point of use rather than risk breakage in transport.

Traditional art-historical discussions of glass continued to treat glass as a luxury item with a focus on decorative museum pieces. Glass has been described as a source of wonder to the Roman populace, and as something that filled the homes of the wealthy as fine tableware, toilet and dressing items, medicine bottles, and as kitchen storage containers. It has even been said to feature in the ceremonial lives of young patrician men, who would place the hair from their first shave in small glass vessels before taking them to a consecration ceremony (Smith 1949: 49-50). Commentaries such as this glamourize the role of glass and omit the mass of fragmentary archaeological material that can shed light on the role of glass in wider society. Discussions of glass exhibitions and private collections often skew the interpretation of Roman glass, because exhibitions tend to show the finest material, and whether intentional or not, authors writing about glass exhibitions, such as Harden *et al*. in *Glass of the Caesars* (1987) or *Glass from the Ancient World: The Ray Winfield Smith Collection* (Corning Museum of Glass: 1957), tend to suggest that it was a highly desirable luxury item (Vickers 1998: 17). Alternatively, one could argue, as Vickers has, that since there is very little evidence of glass being involved in courtly or upper class life – in fact, evidence from Pompeii shows that its use declined sharply when people could afford silver (De Carolis 2004: 75) – glass was perhaps a surrogate item for luxury tableware rather than a luxury item in its own right (Vickers 1998: 18). Axel von Saldern (1991: 112) agrees with this idea for decorative glass, saying that the more decorative a glass vessel was, the more likely it was to be based on a more expensive type of ware. Glass was very cheap, relative to silver, sardonyx, rock crystal, or other precious stones that it could imitate. The use of glass specifically to imitate these materials can find support in primary sources including Pliny the Elder (*Nat. Hist.* 36.199) and Strabo (*Geography* 16.2.25) who speak of it in relation to sardonyx and rock crystal. Glass could be shipped in blocks of several tonnes, and there was a trade in cullet allowing imitation vessels to be produced on an industrial scale as opposed to being rare and expensive (McClellan 1985; Gorin-Rosen 1995; Vickers 1998: 19). Purple and white-banded glass was even used to replicate 'murrhine ware,' which was made from a rare kind of fluorospar from Persia that Pliny calls the most expensive material man could mine (*Nat Hist* 36.204) and which could cost up to 300,000 *sestertii* for a dipper, or 1,000,000 *sestertii* for a bowl (*Nat. Hist* 37.20).

To compare glass to the other materials at a site and to judge its place in the economy one must go to the site reports, because very few writers discuss glass in relation to its economic context. To gather this information from the reports, one must compile data from several different sections or volumes, as has been done for the following case studies. The glass material is often simply a catalogue, and is sometimes difficult to find in archaeological reports. Glass is often tucked away as a sub-section within a discussion of a broader topic. For example, the excavation reports for Usk, where over 2,100 vessel-glass fragments were found (Price 1995: 139), have glass as a relatively small section in the *Roman Small Finds* volume, where ceramics by contrast have multiple volumes dedicated to them. Price's section has a small discussion of each form, followed by an entry for each vessel or unconnected fragment, which provides some brief dating and context information. That is a rather uncommon level of detail for a catalogue. Hanel's (1995a and b) work on Xanten Vetera I, which is heavily referenced for chapter 5 of this thesis, has a section that provides a general discussion about the glass in the main text volume, highlighting important pieces, but in the catalogue volume there is merely a straight-forward list of glass finds with no contextual information at all, aside from the trench number. Such relegation was the same case in C. J. Simpson's 1997 work *The Excavations of San Giovanni di Ruoti,* in which the glass section is small and at the back of volume II entitled *The Small Finds*. In Reese *et al*. (2008), the vessel glass from Winchester is a sub-section within the household utensils and furniture section. The glass from Baden-Würtemberg has its own volume (Hoffmann 2002), but like Vetera I the catalogue entries are minimal and separate from the discussion of the glass, or any discussion of context, making it impossible to distinguish between first- and second-century glass without cross referencing other works for each glass entry. In the separate discussion section, there is some fairly detailed work on each form and on key pieces, but this cannot give contextual detail for each piece on a level that allows for detailed distribution studies without access to other volumes or excavation notes.

Glass is sometimes recorded in a small discussion section of a few pages in length, with the actual find entries being interspersed among a catalogue of all the small finds, ordered by find number, rather than by material, as is the case in the report on the Rhine fortress at Krefeld-Gellep, which has 13 pages dedicated to the discussion of glass, and no unified glass catalogue (Pirling 1974).

Consumption studies that try to look at usage and social roles tend to be relatively recent and are exceedingly rare compared to the studies of other media, or the chemical and art-historical studies of glass. There have been works by P. M. Allison, H. E. M. Cool, and M. E. Baxter that begin to explore the true nature of glass use (Allison 2013; Cool 2006; Cool and Baxter 1999). These rely heavily on their own interpretations of data found in site report catalogues, consumption studies of other materials, and other kinds of social analysis of the Roman world to work out the significance of glass use, rather than comparisons to glass consumption studies from individual sites as the latter is remarkably lacking. Well-documented open plan excavations with both good glass reports and good contextual information are few and far between, and artefact studies in the Roman world primarily focus on the production and distribution of ceramics over and above any other 'small finds,' into which glass is grouped. Allison even states that in order to find a study that could provide good comparative glass distribution data for her work on the Insula of the Menander, at Pompeii (Allison 2006), she had to look outside of Italy to a handful of forts on the Rhineland and in Britain (Allison 2013: 40). Allison has carried out small finds consumption studies, which include glass vessels, at Roman forts at Vetera I, Rottweil (*Ara Flaviae*), Oberstimm, Hesselbach, and Ellingen (Allison 2013). These studies look for evidence of who was actually using objects, whether objects are inherently masculine or feminine, or military or civilian, and how the objects were used. These studies focus largely on gender roles and fortress occupancy as they move from building to building in their attempt to define who was using each space and the items found within. Distribution maps and graphs for Vetera I (Allison 2013: 366-377), in Allison's study of military sites set an example for the kind of work that could be used to identify the usage patterns and significance of glass, but not surprisingly, considering the focus of most consumption analysis, she herself does not include charts or maps tracing the glass at most sites. Instead, she focuses on the densities of fine ceramics, utilitarian ceramics, and coins.

While Allison sheds some light on who was using glass, and the purposes of certain vessel forms, glass is, as usual, not a primary focus. She notes a relatively high number of tubular, and pyriform, perfume and cosmetic bottles found in military bases, noting that, while perfume was not exclusively feminine in the Roman world, it is predominantly associated with women (Allison 2013: 100; Stewart 2007: 71, 75-78).

The presence of aryballoi are noted to indicate bathing and medicinal practices, as they are primarily associated with perfumed bathing oils, but have also been found along side medical instruments in graves (Allison 2013: 100). This does not tell us who used the aryballoi, but suggest that even on the frontier, all the comforts and accoutrements associated with Roman bathing were expected.[23] Allison goes on to highlight a glaring omission in the practice of glass consumption analysis, which is that the use of small glass cups and bowls has largely gone unexplored. She notes that they are generally assumed to have been used for serving, eating, and drinking, and have been found alongside other tableware in the *Casa del Menandro* in Pompeii (Allison 2013: 103; Allison 2006: 197-208), but she does nothing further with this study to provide further evidence.

The only people who have looked into the use of cups and bowls in detail are H. E. M. Cool and M. J. Baxter in their 1999 article on comparing glass assemblages, and Cool, on her own, in her 2006 book on eating and drinking in Roman Britain. They look at the shapes of cups and bowls, as well as where they were found, to consider how they may have functioned, and how eating and drinking habits may have changed or varied in different contexts. Cool argued that the large glass bowls, particularly the strongly ribbed, cast Isings Form 3 pillar-moulded bowls, which dominated the glass assemblage from pre-Boudiccan Colchester, were likely for drinking, and she bases this on a rim shape that is conducive to just that. She also points out that bowls were likely used for drinking, because of a lack of cups and beakers in the early levels. There are a few, but they do not appear to have become popular until later in the first century, potentially indicating a change in drinking habits (Cool 2006: 178). Cool also notes that these large bowls were dominant drinking vessel forms in barracks blocks, such as those at Lion

[23] Evidence from Pompeii shows that occasionally aryballoi were used to hold food condiments, and maybe even paint (Allison 2013: 101; Allison 2006: 80. 22-23. 375-377; Price 2005: 180).

Walk and Gilberd School in Colchester, but were rare in the high-status site at Culver Street. The tribune's houses and other high-status locations contained more small cups suggesting that there was a difference in the drinking habits of the men and the officers. Cool suggests that it could be a matter of communal drinking, out of big bowls, versus individual drinking, out of cups; or beer drinking, which was common among soldiers in Britain and is drunk out of large vessels, versus wine drinking (Cool 2006: 140-143, 178; Cool and Baxter 1999: 81). This pattern actually goes completely against the idea that cast vessels were luxury items used by the wealthiest citizens.

Cool and Baxter explored differences in vessel preferences across different contexts in Roman Britain. They noted that, while sample sizes were small and subject to change, there was a clear pattern of a preference for large vessels and storage containers in military sites compared to civilian sites, where there was a preference for smaller drinking vessels and serving jugs. Cool and Baxter have interpreted this as suggesting that native populations adopted glass to use as tableware, but were slower to adapt to Roman diets, which required the foreign imports that were stored in glass bottles and jars. Alternatively, it could indicate that soldiers had more need to store large quantities of foodstuffs than urban populations did (Cool and Baxter 1999: 83-84, 93). They also trace regional usage variations between the north and south of Britain (Cool and Baxter 1999: 90), and show how data can be compared across sites, which will be explored more in the third chapter of this thesis on the Usk fortress, and in the seventh chapter on cross site comparisons.

1.2.4 Problems With the Current Study of Glass

Discussions of glass in the Roman economy focus on late antiquity due to the increase of glass production in the late Empire[24] and the amount of early evidence that has been lost to recycling. Studies such as Isings' *Roman Glass from Dated Finds* (1957), and most excavation reports focus on forming typological sequences to figure out chronology, production, and broad distribution of vessel types, but there is little discussion of use and intra-site distribution (Allison 2013: 36). There is also little discussion of glass in relation to other industries apart from noting when a vessel copies another medium, which, as Grose (1989: 243) notes, was a declining practice in the early Empire. Among the few who try to discuss glass in the context of the broader Roman economy, most do so with brief, but very definite-sounding statements, which are often not supported with any specific reference data from the archaeological record. For instance, Stern comments on the importance of glass at the Vesuvian sites where glass was found in context alongside ceramics and metal-ware. She said that glass outnumbered thin-walled ceramics by as much as two or three times, but there is no reference to reports that provided this data or any allowance made for the loss of certain materials to looters, the destruction of thin-walled material, possible collection of materials by residents who returned after the eruption, or those who carried away certain items during their evacuation (Stern 2004: 103). Stuart Fleming also makes a broad unsupported statement that, by A.D. 116, as many as eight million households in the Roman Empire would have been using 60 or more pieces of glass every day, including toilet items, tableware, and storage containers (Fleming 1999: 60). He then estimates that if each household broke around a dozen items per year, glassworkers would need to produce about 100 million items a year to keep up with the demand. That is without

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[24] Plant ash became more common as a flux allowing glass to be produced in more places and changing the entire trade system of glass in the Mediterranean (Saguí 2007: 220-221).

even considering households that used under sixty pieces a day. While this is a tempting statistic and it indicates the possible importance of class to the ancient Romans, it is just an estimate, and Fleming provides no supporting evidence or explanation for how this estimate was reached (Fleming 1999: 60). David Grose went so far as to say that as glass became available and inexpensive, in the Augustan and Julio-Claudian period, it competed with metal and pottery, and even caused the end of some ceramic traditions (Grose 1989: 241). He does not, however, provide numbers to support the decline in any ceramic form, and notes thin-walled pottery as an example of a ceramic tradition that ended. Treating glass in this manner does not allow us to understand how it fit into the Roman economy, or how the industry developed. The archaeological record does support the statements that glass was used by Romans at all levels of society, and in large quantities, so it stands to reason that it was a substantial part of Roman trade and there is a gap in the data that needs to be filled.

Overall, free-blown glass is overshadowed in the literature on early-Imperial glass, by mould-blown wares, which are the focus of art-historical discussions. One cannot be entirely surprised by this, since the artistic mould-blown wares, about which more can be said, followed the stylistic trends of the time, allowing for comparisons to other media. Mould-blown wares, of both decorated and undecorated varieties, could also contain moulded maker's marks that provide tantalizing hints about who was producing glass. These features provide more points for discussion in catalogues or discussions of production techniques than do the features of the majority of free-blown glass, and the majority of glass literature is focused on interesting features that stand out. If one does, however, look past the general discussions and wade though the catalogued glass of sites or collections, one quickly sees that free-blown glass was very prominent in the Roman glass industry. The entries are often short, with very little detail, because they have less decoration to discuss and fragmentary body shards of free-blown glass are less easily categorised than shards with recognizable moulded patterns. Even the majority of mould-blown glass that has been found is catalogued with just a few lines in a long list of items that simply describes colour, size, decoration, and where possible form. For the huge quantity of glass that has been uncovered, there are few pieces that provide new information about the glass industry and the people involved in it, without considering their contexts and comparing them with other glass vessels of the same time period, as well as that which came before. If glass is looked at in that way, as is the aim of the following case-studies, and can be compared to other materials in similar uses, then it will be possible to expand the body of knowledge of the early-Imperial Roman Economy.

1.3 Tel Anafa: Glass from a Pre-glassblowing Roman Context.

The site comparisons that will be made through the case-studies in the later chapters of this thesis seek to identify the relationship between cast and blown glass. The aim is to discover if glassblowing really did take over glass production across the social spectrum, as would be expected if it was a vastly more affordable and rapid production technique that was responsible for spreading glass use beyond the wealthiest levels of Roman society. Before we get to those studies, it is necessary to look into the amount of glass, and types of glass in use before glassblowing. This will help us to understand the changes that happened following the invention of glassblowing, and to understand the role of glassblowing in these changes. An effective comparison is difficult within the confines of the western Empire due to the dearth of glass prior to Roman expansion to the western provinces, which followed the invention of glassblowing. The foundations of each western frontier site in this thesis all date between 50 and 100 years after the invention of glassblowing (King 1990: 42;

Lendering 2003; Lendering and Bosman 2012: 173; Price 1993: 67). Excavation decisions at Herculaneum and Pompeii also strongly limit access to pre-eruption period layers, so although the sites are old enough to have had glass before glassblowing, a comprehensive study is impossible. In order to make meaningful comparisons with a site that has a significant glass assemblage, which is confidently datable to the period before glassblowing, it is best to look to the eastern Mediterranean where there is a longer tradition of glass use.

The site of Tel Anafa, in northern Israel (Fig. 1.6), has a long history of sporadic occupation with well-defined Hellenistic and Early Roman periods for which there exist remarkably detailed catalogued glass assemblages, with detailed dating divisions (Grose 2012: 1-98). The periods of interest are recorded as HELL 1B (198-125 B.C.); HELL 2, 2A, and 2B (125-75 B.C.); and ROM 1 (late first century B.C.- early first century A.D.) (Herbert 1994: 26). Grose's report on the glass enables us to look at the types of glass vessels in use in each period, and the ROM 1 period can be compared to the others to see the first emergence of blown glass at a site with a long glass tradition. Accompanying reports, on the plain ceramic wares, and fine ceramic wares by Andrea Berlin (1997) and Kathleen Warner Slane (1997) respectively, allow for an evaluation of any impact glassblowing may have had on the relationship between ceramics and glass. The quantity of glass and ceramic objects of similar types from the pre-glassblowing periods can be compared to one another. This relationship can then be compared to the glass and ceramic relationships from the sites examined in the chapters to come, which were founded after the invention of glassblowing.

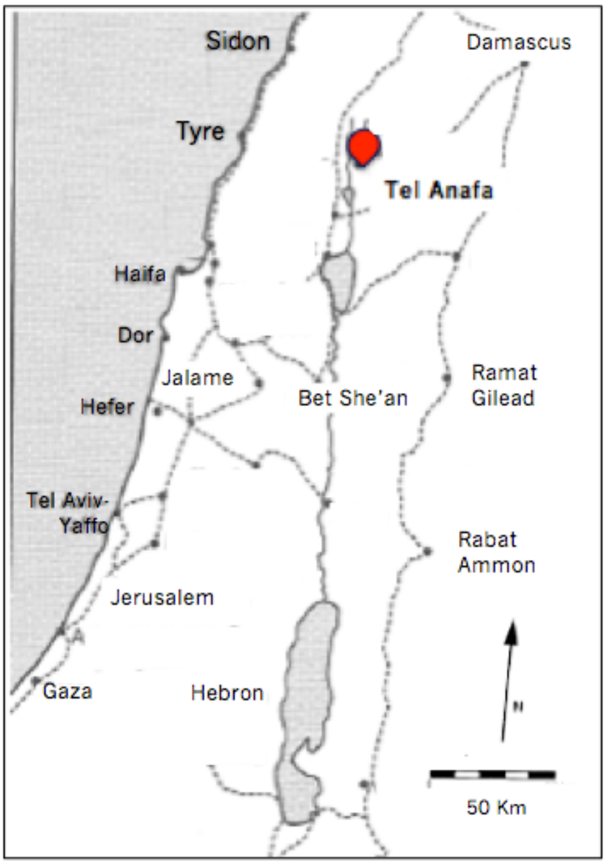

Figure 1.6: Location of Tel Anafa (After Grose 2012: 2 Illustration 3)

The Universities of Missouri and Michigan excavated Tel Anafa in ten excavations divided between two series spread between 1968 and 1986 (Herbert 1994: vii, 9). The site has no known name from antiquity and its role remains unclear. It was, at its largest, a town, although Grose debates the identification of the site as a town, and also dismisses the idea of it being a fort or sanctuary, suggesting that it may instead have been a country retreat for a rich merchant or an aristocrat (Grose 2012: 3; Herbert 1994: 1). The main construction period for the Hellenistic remains on the Tel date *circa* 125 B.C., with major renovations *circa* 110 and 100 B.C. This construction centres on a large building that is used to identify the HELL 2 strata. Anything with Hellenistic remains predating this is identified as HELL 1 (Slane 1997: 257-258).

The site then appears to have been abandoned around 80 B.C. and then reoccupied late in the first century B.C., possibly coinciding with Augustus' gift of the region to Herod the Great *circa* 20 B.C. The earliest datable coin evidence comes from clusters dating 4 B.C. to A.D. 34 and 6 B.C. to A.D. 15 (Grose 2012: 3; Slane 1997: 258). This Roman-era settlement was not as large as its predecessor and was comprised of around 12 mostly small one or two room rubble houses. It is tentatively identified as an agricultural village or small military outpost. In spite of the modest structures, the site contains fairly stylish imported goods of Roman styles, including *sigillata* wares, lamps, Roman coarse-ware pans, *mortaria*, and casseroles suggesting Italian cooking and eating habits (Berlin 1994: 30-32; Grose 2012: 3; Slane 1994: 261-262).

Tel Anafa has great significance for glass studies because it has high levels of late-Hellenistic glass and has more early Roman material than any other Levantine site, within a reliable chronological framework. This allows for a good understanding of forms in use and the development of the industry (Grose 2012: 1; Herbert 1994: 1). Grose (2012: 1) identified over 4,000 glass fragments from excavations covering just eight per cent of the Tel, which included 50 per cent of the habitable space within the Hellenistic enclosure, and there were over 6,000 glass fragments from the site as a whole (Herbert 1994: 1). From these finds one can see a stark contrast between the variety of the glass at this early site and the wide diversity of glass that can be seen at the other sites in this thesis. Grose notes only 12 Hellenistic styles or classes of glass, and 90 per cent fall into just three categories: Hellenistic grooved bowls, Roman ribbed bowls, and Roman linear-cut bowls (Grose 2012: 1). The cast, grooved bowls make up over 99 per cent of the Hellenistic glass (Fig. 1.7); and cast, ribbed bowls make up nearly 72 per cent of the Early Roman material on the site (Grose 2012: 1).

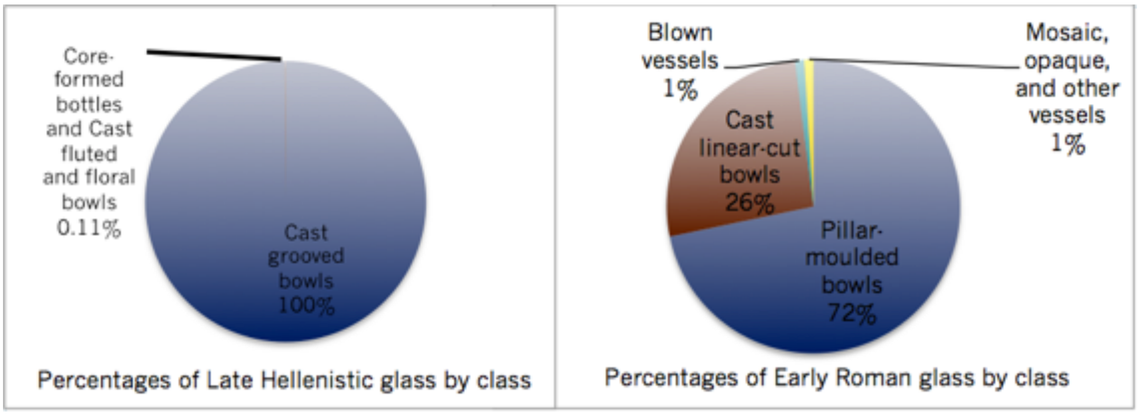

Figure 1.7: Late Hellenistic and early Roman glass production percentages at Tel Anafa (After Grose 2012:1, Illustration 1).

The Roman material includes a few examples of early blown forms from the Augustan and Julio-Claudian periods, but these only make up one per cent of the total Early Roman glass. This indicates that the invention of glassblowing did not immediately instigate an explosion of new forms and that casting continued to be the predominant production type in the opening decades of the Imperial Period. Furthermore, there are few first-century tableware forms, as well as a total absence of early mould-blown forms, which appear around A.D. 25. This absence of mould-blown wares suggests that the early Roman occupation was short lived, and may have been over by the reign of Claudius (Grose 2012: 3).

A direct comparison of the total numbers of glass vessels in the second and early first centuries A.D. and the vessels from the early Roman occupation, which closely follows the invention of glassblowing, cannot be used to prove that glass use was more or less popular on one side of the technological change or the other. This is because the relevant Hellenistic glass comes from a substantially longer time period, and disruption caused by modern farming on the site has scrambled large numbers of fragments among different strata. This means that, while the forms can usually be assigned to a broad time period such as HELL 1, HELL 2, or ROM 1, it is not possible to quantify all of the vessels from equal time periods on either side of the invention of glassblowing. If one were to just look at the quantity of vessels in each broad category it would appear that glass use became less popular after the invention of glassblowing since there are 243 vessels recorded from the Hellenistic period, and only 163 from the early Roman occupation. If one considers the time scale, however, the picture changes drastically, as the early Roman occupation only lasted for approximately 70 years compared to the 120 or so years of the late Hellenistic occupation, at least 80 of which were in the HELL 2 phase. Additionally, the Roman-era occupation was on a smaller scale (Grose 2012: 3). These factors suggest that glass had proportionally higher use in the early Roman period, following the invention of glassblowing, but when the distribution of production types is examined, it quickly becomes clear that glassblowing cannot be held responsible for the increased use of glass. Cast glass outnumbers blown glass by a ratio of almost 8.6:1, with 146 cast vessels and 17 blown vessels being attributed to Roman-era forms (Grose 2012: 27-77).

Cast vessel numbers from Tel Anafa are predominantly made up of sagged vessel forms. Just over 70 per cent of the cast vessels are heavy ribbed bowls of Isings Form 3 (103 examples) with a further 27 per cent of the cast vessels being sagged bowls with linear-cut decoration. Most of the bowls are ordinary utilitarian vessels as only three of the Roman-era bowls are made out of mosaic glass. Casting seems to have been the favoured production method for bowls since only 12 bowls from the site are blown, and the remainder of the blown vessels are for small bottles that would be difficult to produce through casting. The numbers here would indicate that glassblowing was not immediately responsible for the spread of glass. People in the Roman world were using glass prior to, and after the invention of glassblowing without relying on cheap vessels produced through blowing. The expansion of glass use at this site, including typical Roman forms such as the Isings 3 bowl, was occurring under Roman hegemony faster than the rate at which glassblowing was becoming the dominant production method, suggesting that glassblowing cannot bear sole responsibility for glass becoming commonplace.

The site at Tel Anafa is also useful for evaluating whether or not glass vessels started taking over roles from ceramics. If the glass vessels from the pre-Roman period are considered (Grose 2012: 19-52), the total of 243 vessels pales in comparison to the 3571 ceramic vessels recorded by Andrea Berlin in her study of the plain pottery (Berlin 1997: 24). This is a 14.7:1 ratio of ceramics to glass and does not even include fine ceramic wares. There are 709 Roman-era plain ceramic wares by comparison making their ratio against the corresponding glass-wares only 4.3:1. Only 22 of these coarse Roman ceramics were tableware items, which might lead one to suspect that glass was becoming the dominant material favoured for the table. However, the fine wares must be considered to determine whether this diminishing gap between materials is more to do with the types of ceramics in use, or the difference in wealth, than with glass taking over in certain roles. The apparent dominance of glass on tables may be diminished or even disproven, once fine wares are considered.

Fine ceramics are much more likely to be used for tableware than for storage, or any of the other purposes for which pottery was used, so it is the key material against which glass ought to be compared in the Roman period. The Roman fine wares are primarily comprised of Eastern *Sigillata* (97 %), divided into the categories ROM 1A "Herodian" and ROM 1B "Roman," with a few regional, or imported Italian fine wares, (Slane 1997: 255, 261). There are some 36 different forms of fine-ware cups and plates totalling some 9064 vessels from the Hellenistic and Roman periods (Slane 1997: 265, Fig. 3). These Roman-era Eastern *Sigillata* forms total an estimated MNI of 905 vessels of 11 different types (seven plate forms and 4 cup forms), showing that ceramics were still more highly used than glass in the early Roman period, both before and immediately following the invention of glassblowing, although the gap between materials was narrowing, at least in terms of fine tableware, with only a 5.5:1 ratio of fine ceramic wares to glass (Slane 1997: 267, Fig. 6). The low levels of blown glass, however, show that the narrowing gap was accomplished with cast glass vessels rather than through a large influx of blown glass.

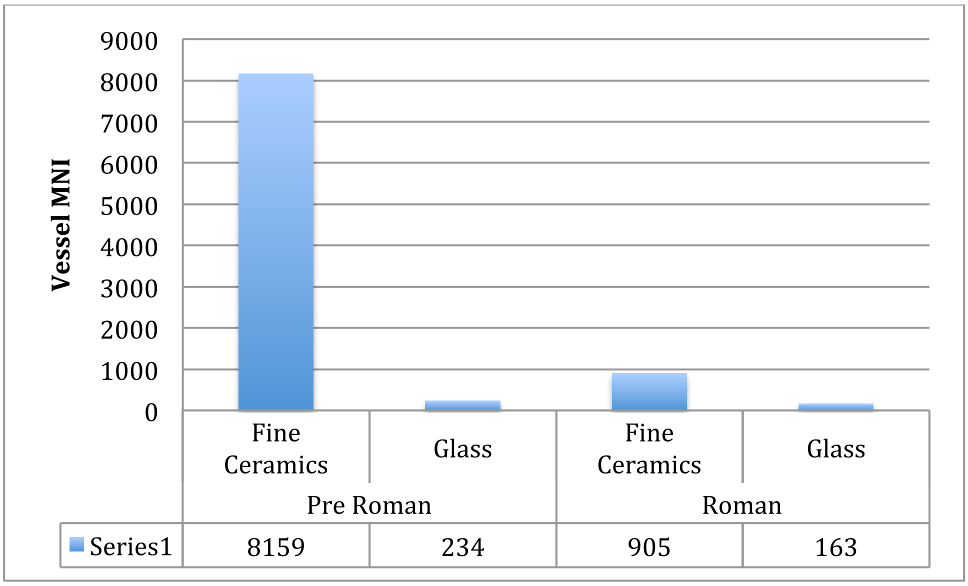

Figure 1.8: Relationship between fine ceramics and glass in pre-Roman and Roman contexts at Tel Anafa.

While it is difficult to directly compare Tel Anafa to the other sites in this thesis, it does serve to show that cast glass was not a limited luxury item that was easily supplanted by blown glass. In fact, the much lower level of blown glass compared to cast glass that is seen at Tel Anafa might indicate that blown glass was slow to take off in the early Roman period, before Roman hegemony allowed for the spread of craftsmen and the trade in goods across wide areas. It may also suggest that blown glass was slower to be accepted in places with very long histories of glass use in the East, than it was in the West, where there were few glass vessels until the arrival of the Roman army, or on the Italian Peninsula itself. In the latter case, glass had been in use for centuries before glassblowing, but as Rome established its control over the eastern

Mediterranean region, where glassblowing was discovered, many craftsmen were brought back to Italy, bringing with them their new techniques (Harden 1935: 164-169).

Chapter 2 : Methodology

2.1 Creating a Methodology

In order to understand the relationship between glassblowing and older casting techniques, and to be able to evaluate the true impact of glassblowing on the use of glass in the early-Imperial Roman world it is necessary to have a consistent methodology and a meaningful set of glass with which to work. A range of assemblages from different sites were selected in order to provide a wide enough sample size to see emerging patterns in glass use, to avoid being swayed by a single anomalous assemblage, and to avoid becoming too large a study for the time and money constraints of a Ph.D. project. Deposition and recycling had to be considered when selecting sites, as these can remove items from their primary usage context and lead to an amalgamation of material from different time periods. Excavation and recording biases were also taken into consideration. In addition, the materials at the selected sites had to be stored together in locations that were accessible and affordable for study, rather than dispersed through various museums and private collections.

Once sites were selected it was key to have a uniform system of vessel identification that could be used for all of the case studies. In this way, patterns of vessel use could be compared across sites in a like-for-like manner that would avoid comparing vessels with very different functions. Along with the methodology for identifying fragmentary vessels, there had to be a standard practice for identifying production type, for quantifying the vessels at each site, and for working out proportions of assemblages that represented each production type to allow for meaningful cross-site comparisons.

2.2 Site Selection

Sites that would be practical and meaningful for understanding the quantities and types of glass being used in the first century A.D. were targeted. The goal was to find a selection of sites that represented several different social contexts present within the Empire in order to look for consistent patterns and avoid misinterpretation based on a single anomalous site, or a single type of site. Due to the limited nature of glass publications, it was of the utmost importance to select sites where the physical assemblages were available to study. The traditional cursory publication of glass that is not readily identifiable leads to the omission, or lack of interpretation, of large amounts of fragmentary material in publications. There is typically a divide between excavation research plans and artefact studies that leads to compartmentalised publication with the information on artefacts being isolated from contextual information (Allison 2013: 36-38; Allason-Jones 2012: 474; Ettlinger *et al* 1990; Willis and Hingley 2007: 2). In order to gain any insight into the consumption of glass, it is necessary to carry out a detailed study of the physical remains to identify forms, functions, and production types; and to be able to trace context information from storage records – where available –, or from detailed catalogues, and then to tie the various contexts to separate excavation reports.

The initial plan was to have a wider study that incorporated sites in the Levant near the earliest glassblowing evidence, and possibly some of Roman North Africa, in addition to some western sites, in order to create a better continuum of glass industry development. These plans had to be postponed to potential future work due to realistic time and budgetary restraints, and the onset of the Arab Spring in key locations within the first year of the project. Instead, the focus of the study is on the presence of older production methods in the west and the relationship between them and blown glass. Such a relationship is of interest when considering the role played by blown glass in making glass widely accessible. If blown glass was truly much better, and both cheaper and quicker to produce, it would stand to reason that older techniques might have died out more quickly and would not have continued to be exported to newly Romanised territories.

Sites were chosen to represent military settlements, both legionary and auxiliary cavalry, and civilian settlements both at the heart of the Romanised world, and on frontiers where camp followers, veterans, and conquered non-Roman people would have mixed. The site selection also attempts to provide sites that contain –where relevant– domestic, commercial, and public spaces, and contexts relating a cross section of society based on wealth.

Finding useful sites was a challenge because of the low standard of early excavation, retention, and recording practices; the limited publication of materials available for study; and issues of distinguishing Roman glass of different dates. There were further challenges in identifying assemblages that could provide 'snapshots' of usage patterns in relevant time periods, identifying unique contexts within a site to chart change over time, and in accounting for fragility and recycling, to ensure that results are meaningful.

An ideal site would have a substantial excavated area, covering the entire range of social contexts contained in the entire site. Such a site would have a sealed context brought on by sudden destruction or abandonment, helping to avoid contamination by later material, which cannot always be distinguished in the absence of clear forms or in the cases of forms that had a long period of use (Allison 2013: 51). Sudden destruction and abandonment may also reduce the impact of recycling on the assemblage, allowing for a more accurate cataloguing of the amount and types of material in use at the end of the occupation period. This is an ideal scenario, which is rarely available to archaeologists (Allison 2013: 39). In some cases, the sudden abandonment of a site may make it easier to determine where in the site the original vessel was actually used, but immediate reoccupation of a site, before the remains become hidden, may result in the displacement of artefacts during the robbing of building material. Reuse of building material was common practice in the ancient world, and in medieval towns that grew up on top of, or in close proximity to, Roman remains (Cool and Baxter 1999: 74). In the case of military sites, destruction may be preferable to abandonment because of the Roman practice of systematically dismantling forts to prevent their reuse by the enemies of Rome (Allison 2013: 51). This results in the removal of reusable material and makes it challenging to find objects in usage contexts, but preserved sites with destroyed forts that were not subsequently built upon are few and far between (Allison 2013: 39). A final feature of an ideal site for this study would be the extensive excavation of clear, pre-blowing contexts, and well-defined stratigraphy, as well as a final first-century A.D. abandonment phase so that a progression in use could be traced.

Unfortunately, sites with all of these features are merely an ideal and are not readily available for study. As a result, it was necessary to choose sites that had some of the ideal features, and met the practical and accessibility requirements for this study. The most significant criteria selected for this study, aside from the mandatory qualification of having a significant glass assemblage to study, are sudden destruction, or abandonment combined with short occupation, and resulting sealed contexts in which the date of the material can be confidently assigned to the relevant first-century A.D. time period. The selection of sites used in this thesis – Nijmegen-Oppidum, Batavorum; Nijmegen, Kops Plateau; Xanten, Vetera I; Usk, Herculaneum; and Pompeii – all have terminal dates between the late 60s A.D. and A.D. 79.

The two Nijmegen sites, as well as the Xanten site had relatively short periods of occupation – only a few generations – which helps to restrict all of the glass found on the sites to the first century of glassblowing. This provides us with a relatively good 'snapshot' of what was in use at the time. All three sites were destroyed suddenly in the Batavian Revolt of A.D. 69/70 meaning that it was not possible for the glass in use at the time to be collected for recycling. The destruction also created a burnt layer that helps to distinguish between glass from before and after the end date for this study. Furthermore, the reoccupation of Nijmegen consisted of a legionary fortress, constructed near to, but not on the same site as the cavalry fort used in this study, so that its material did not intrude upon the assemblage being used (Lendering 2011). The new fortress at Xanten was also constructed on a new site, and the Vetera I site was never intensively occupied after its destruction (Hanel 1995a: xi; Lendering 2003).

The excavation layers at the Usk site were not contaminated by previous occupation, as the site was constructed on virgin soil. This site had a very short occupation period of roughly 20 years before its systematic demolition, which again contributes to it being a narrow snapshot of glass use in a specific time period. There was little subsequent occupation on the fortress site until modern times. A small Roman fort did briefly occupy part of the site in the early-Flavian period, but even contamination form this period would fall into the first-century and within the limits of this study. The medieval occupation of the region was focused on a raised promontory that lay north of the fortress site, rather than on it. Some problems may arise due to the systematic decommissioning of the site, which prevents the material from being found in usage context. Also, much of the useful material may have been removed, but what is left may still be a good representation of the types of vessels in use and the production types that were available to the occupants. The impact of decommissioning on this site may be possible to judge by comparing its assemblage to those of the two other military sites, which were destroyed suddenly rather than decommissioned.

Herculaneum and Pompeii are well known for their sudden destruction in A.D. 79, and resulting sealed contexts. While it was initially hoped that their long history would provide evidence of Roman glass use before glassblowing as well as evidence for use in an excellent range of social contexts at the time of the eruption, excavation biases have prevented the collection of enough information from earlier layers to form a suitable study.

Also important, but of secondary concern, was that each site needed to be excavated extensively enough so as to allow for a variety of wealth levels to be represented. In the case of military sites this involved excavations that contained both barracks blocks, and officers' housing. In selecting civilian settlements it was desirable for domestic, commercial, and public space to be represented, as well as wealthy, and poorer contexts to allow for a comparison between the types of vessels used in each context. This was simple to accomplish in the large open excavations of Pompeii and Herculaneum, but there was more restricted choice and less contextual information available for Nijmegen- *Oppidum Batavorum*.

Military forts and fortresses are typically Roman and provide excellent examples for a range of wealth levels, meaning they may be at least somewhat representative of Roman society as a whole (Allison 2013: 19). They have often been treated as "quasi-monastic," (James 2001: 80) masculine, and rather Spartan contexts on the edge of the civilised Roman world, with any servants, traders, and camp followers living outside the boundaries of the fort or fortress, but evidence suggests that they are much more varied (Allison 2013: 1, 12). It now appears that there was much more social variety within permanent, or semi-permanent military camps than previously thought. Officers' families, including the broader *familia* of senior legates; regimental servants; support personnel, such as animal handlers; craftsmen; traders; and prostitutes all would have spent time within the walls of the camp alongside the citizen-soldiers (Allison2013: 1; Haynes 1999: 2). There is even evidence from tablets at Vindonissa that show a craftsperson and a female barmaid or innkeeper operating their businesses within the confines of the fort (Allison 2013: 1-2, 28; Speidel 1999; Speidel 1997). Further evidence for people other than soldiers occupying Roman forts include children's shoes in fortress rubbish heaps and inside barracks at Vindolanda, near Hadrian's Wall and Bar Hill, on the Antonine Wall (Roberston, Scott, and Keppie 1975: 64; van Driel-Murray 1995; van Driel-Murray 1994). Some sites have even contained infant burials under centurions' houses (Allison 2013: 2; Trumm and Fellman Brogli 2008: 103-104).

The *Praetorium* and *Principia* are easily defined locations in military sites that represent the high levels of society. The first-century military was commanded by men of senatorial rank, who were generally accompanied by their families, at first just in winter, under Augustus, then on a more permanent basis (Allison 2013: 13-14; Cassius Dio 60.24.3; Tacitus *Annals* 1.69, 2.55.5, 3.33.5; Juvenal *Satires* 6.398-405; Herodian *Histories* 3.8.4-5). The houses near these structures were often occupied by wealthy Tribunes and well-paid centurions, the senior of whom may have been allowed to marry, even before the end of the marriage ban for soldiers, and may have kept families in their luxurious quarters at the end of barracks blocks (Allison 2013: 25-26). The lower-rank enlisted men of the army, in the period covered in this thesis, would have been recruited largely from landless citizens, who were attracted to army life by the promise of a pension, land, and the chance for war booty. The sites covered in this study all date well after the reforms of Marius, prior to which the legions were comprised of citizens wealthy enough to supply their own armour and weapons, and the poorest citizens were exempt from service. These sites also predate the pay increases of Domitian, let alone the huge increases of the third century.[25] In this period, soldiers only earned a salary of 225 *denarii* per year, less camp fees for equipment and food, and the burial fund (Alston 1994: 114; Elliot 2014: 22, 103-109; Rodgers and Dodge 2009: 132-139, 162; Roueché 1989: 265-361; Speidel 1992: 87-91).

Civilian sites can give us a good idea of what was popular at the heart of the Roman world, and whether there was a difference on the frontier. Frontier *vici* or *canabae* such as *Oppidum Batavorum*, at Nijmegen can also be used to see what the impact of non-Roman tastes were on usage, since they would have been home to a blend of local populations, and Romans. Perhaps more tellingly, these sites can hint at the Roman impact on local tastes. Frontier sites housed traders, craftsmen, families of soldiers, other camp followers, and veterans who were settled in order to Romanise the provinces. In spite of the civilian label placed on these sites, the camp connections often impart a strong military presence as more veterans settle and soldiers interact with the populace for goods and services (Allison 2013: 23; Haalebos 1991; Haalebos 1998). It has even been argued that: "Nijmegen's *canabae* was more Roman than Germanic, and more military than civilian" (Allison 2013: 23-24; Franzen 2009: 1279-1280).

2.3 Identifying different vessels

Colour is described on a fairly basic level in this work. Describing glass colours can be contentious, as the appearance can change drastically with variations in thickness, transparency, and surface wear, and because even the same piece can change colour noticeably in different lighting conditions. These factors make it very difficult to make accurate descriptions of colour values using colour charts, as different fragments

[25] During the crisis of the third century, generals offered high pay and bonuses (more than double the income of a standard labourer) to ensure the loyalty of their troops after the armies recognised their potential to make and unmake emperors.

of the same batch of the same coloured glass may appear different. Pinpointing a colour value would require equipment to measure light absorbance, which was not possible given the time and money available. To work around this problem, all fragments of a given assemblage were viewed in the same lighting conditions and colour identifications were limited to basic descriptions such as dark blue, light blue, dark green, light green, and so forth. The only cases where there had to be more precise judgements were in descriptions of natural coloured glass. In catalogues the natural coloured glass that is somewhere in the middle of the blue-green spectrum is simply referred to as 'Blue-green,' and this is how all the natural coloured fragments are referred to as a group in this thesis. Where individual fragments are discussed, they are recorded in a way that helps to distinguish between similar fragments of different vessels. Fragments are labelled based on the more dominant hue as was visible in the lighting conditions available during the study, with the dominant colour coming second in the name. For instance, where the fragment had a higher green value it was recorded as 'blue-green,' or 'bluish-green,' and fragments with higher blue values are called 'green-blue' or 'greenish-blue.'

Terms for describing vessel types and specific forms follow Isings Form catalogue, *Roman Glass From Dated Finds* (1957), as closely as possible. Her form catalogue, although over 50 years old, has yet to be surpassed, even though more datable vessels are known and some date-ranges may be extendable. Isings arranged her catalogue into chapters based on the century in which the vessel forms within became prominent. Each chapter is divided into sections based on the primary production type – cast, mould-blown, or free-blown – of the forms contained within. The main weak point of her structure is that, after arranging her catalogue in this way, the forms have been numbered from 1-134 through the whole catalogue, with no regard for chapter or section, leaving no space to insert forms that she missed or that have been identified since her publication (Isings 1957: 15-162). Fortunately, most vessels that can be identified fall into the categories defined by Isings. Her catalogue still functions to ensure that readers understand the vessel types being discussed, and can quickly find a good selection of comparable vessels from dated finds.

All vessels studied here that can be identified as forms represented by Isings use her terminology and form numbering, because her work is a well recognised numbering system. The publications of each of the sites used as case studies in this thesis use her numbers for identification, even when they have their own system for glass vessel identification, as was the case at Herculaneum (Scatozza-Höricht 1986). Occasionally, when a vessel type has not been discussed by Isings, it is numbered using terms specific to the site in question or other descriptive terms. For more generic identifications this thesis still follows Isings catalogue as closely as possible. The term *beaker* is used for any cylindrical or ovoid drinking vessel that is taller than it is wide. *Cup* is used to describe a squat drinking vessel that is equal or less than its diameter in height. *Cups* and *bowls* can often overlap, as bowls are defined by being hemispheric or ovoid forms with a rim diameter greater than its height. Distinctions between bowls and cups are often based on size differences (bowls being the larger of the two forms). *Plate* and *dish* are terms used to describe low-profile, wide vessels. If the rim is out-splayed and the base is very shallow, then it can confidently be called a plate. Anything with a wide diameter and with walls or a vertical rim less than three centimetres in height can be described with either term in the literature. *Bottles, flasks,* and *unguentaria* can sometimes be difficult to distinguish, and terms can fluctuate in different sources. For the purpose of this thesis, Isings catalogue is again used as the guideline with vessels labelled according to which of her forms they best match. Bottle is used for any prismatic or cylindrical vessel that narrows into a neck that is shorter than the body height. Most bottles also have a handle running from the top of the shoulder to the top of the neck or the rim. The publications for Herculaneum and Pompeii often use the Italian *Bottiglia* to refer to any vessel without handles that has an ovoid or pyriform body and resembles smaller vessels recorded as *Balsamari*. These vessels best match the Isings Form 16 and are, therefore, called *flasks* in order to be consistent with this form's description across all the sites of this thesis. Flasks are very close in form to some of Isings unguentaria forms, so are usually distinguished by a judgement call on size. Examples of bulbous or pyriform vessels with tubular necks that are under ten centimetres in height are classed as unguentaria, where those over ten centimetres are distinguished as either flasks or unguentaria based on thickness, rim finishing, and where relevant, consistency with published material. Flasks are generally found to have slightly thicker walls, and are more likely to have folded rim finishes than unguentaria, which usually have cracked-off and everted rims, although, these are not definitive rules. (Isings 1957: 22-23, 34-35, 40-43). Jugs are handled vessels like bottles, but may have longer necks that may make up as much as half of the vessel's height, or may have no neck at all and an open mouth with a pouring spout.

2.4 Quantification

In order to begin to understand the role of glassblowing in the shift in glassware from luxury items to everyday goods within the Roman Empire it is necessary to take a look at the glass assemblages in a variety of social and geographical contexts throughout. To minimise the effect of such issues as recycling and further loss after deposition and view the actual usage of glass through the archaeological assemblage it is imperative that the sites chosen have sudden destruction and abandonment phases without immediate repopulation so that the assemblage was isolated stratigraphically without later pillaging or contamination, and so that there would have been little chance for occupants to take their glassware with them, or recycle it. A short period of occupation is also beneficial, although not always available because this limits the time frame in which occupants could have used, broken, and recycled or discarded glass vessels. If these criteria are met, we can have a fairly good idea from, the glass present in the archaeological assemblage, what forms and quantities of glass were in use in the years leading up to the destruction of the site.

For the assemblage to be of any use for determining the use of glass and the role of glassblowing on the site it is necessary to find a way of counting the vessels represented and of being able to divide them by form and production type. All of these things can be very challenging tasks considering the fragile nature of glass.

2.4.1 Quantification methods

When examining the changes to the Roman glass industry brought about by the introduction of glassblowing it is critical to compare the prevalence of various production types. In order to do this, it is imperative to produce an accurate count of the vessels produced through casting, core-forming, free-blowing, and mould-blowing.

Quantifying archaeological assemblages can be a relatively simple procedure when dealing with certain types of artefacts that are found whole, but when dealing with objects such as ceramic or glass vessels, establishing an item count can be a difficult and contentious matter. This difficulty was expressed well by Clive Orton (1980: 156) who said; '…a coin is a coin, and there's not much doubt about that. But what are we to do about objects that are found broken more often than not'. In other words, objects such as coins can be counted and, for the most part, each one can be recorded as a distinct member of its assemblage. Coins, of course, were sometimes cut or otherwise altered for various reasons in antiquity, including decreasing value to make change, demonetisation for offerings, destroying counterfeits, or for personal or political reasons (Buttrey 1972: 31), but they are found whole most of the time and thus function well enough to express Orton's idea. In the case of glass vessels, and other breakable artefacts, multiple fragments may represent single items, even when not found in the same immediate vicinity. Even if every fragment of all the vessels in an excavation were recovered – an exceedingly rare occurrence, as many vessels can be broken down into unrecognizable sized and be missed in excavation, and some may have been collected for reuse for another purpose or for recycling[26] (Orton 1980: 161) – there is simply not time to connect each fragment to the correct vessel and create distinct easily countable reconstructions. Due to the inability to count fragmentary artefacts simply, it becomes necessary to find other, more creative ways to quantify these assemblages.

The problem with trying to quantify glass assemblages accurately is that there is not a standard recognised practice that is entirely satisfactory. Most techniques tend to follow practices utilised in the study of ceramics, which should, in principle, work the same way for both glass and ceramic vessel assemblages, because both types of artefacts come in relatively similar forms, and present the same major problem: Both glass and ceramics are found most often in broken states, with individual vessels being represented by either single fragments, or a handful of fragments. The four main approaches for quantifying these assemblages are fragment count, fragment weight, estimated vessel number, and estimated vessel equivalency (Orton 1980: 167). The problem then is that there are additional factors to consider when looking at glass compared to ceramics. There is a wider variety of colours, varying degrees of opacity, a lack of standardisation for sizes and finishing techniques within forms. These factors can all complicate the quantification of fragmentary glass vessels, so any researcher

[26] Roman glass recycling is well-attested in debris at known production sites (Cool and Baxter 1999: 74).

studying glass must determine what exactly he or she is attempting to learn from the assemblage, and which quantification technique will best meet the necessary requirements and can address all relevant factors. Only once this decision has been made and an assemblage has been quantified can a researcher move on to the even bigger questions concerning how representative the assemblage is of an entire site, its context within a site, how the 'site' is defined, the use of the finds (Orton, Tyers, and Vince 1993: 166), and what the assemblage can illuminate of its historical time period.

To gain an understanding of the quantification methods that are used and the value of each for quantifying vessel assemblages it is necessary to look at how each method is used, how it works with glass, and whether or not it addresses the issues that complicate glass and set it apart from ceramics.

2.4.2 Fragment Count

The simplest method of counting a glass or ceramic assemblage is fragment count, but it has limited practicality, and any researcher using this method must consider its value to the aims of their study carefully. Counting fragments simply reveals the number of individual pieces and ignores the original number of vessels that would have been used, making it ineffective for any study of usage patterns. Fragment count is unreliable even for determining the simple quantity of glass in an assemblage or for drawing comparisons of total quantities of glass between assemblages, because assemblages at sites with more opportunity for breakage appear larger than those at sites that have had less occupation and disturbance since the deposition of the vessels. This method may not even be consistent for subsequent studies of the same assemblage if there is any further breakage in storage or transport between periods of study. The fragility of archaeological glass makes this a very real risk and has been witnessed first-hand by the author when examining catalogued assemblages, some of which (*e.g.*

portions of Xanten, Vetera I; Pompeii; and Herculaneum) were excavated before or between the First and Second World Wars and have been through bombings and museum moves.

A further problem resulting from the fragment count method is that if it is used to try and look at numbers of fragments of varying vessel types, then it will generally under-represent sturdier vessels. Sturdy vessels will normally break into fewer fragments than their more delicate counterparts and, therefore, will appear to have been present in smaller numbers. The vessel forms that break into more fragments will appear to be much better represented on the site even when they may actually be represented by the same number, or even fewer vessels than durable vessel that are not as badly broken (Orton 1980: 163; Fletcher and Heyworth 1987: 36).

Fragment count can be very useful, however, for certain types of studies, when combined with other quantification methods. If the number of vessels is determined through the use of another method, then fragment count can be extremely significant for studying fragmentation and deposition patterns. On its own, however, fragment count simply cannot provide information about vessel numbers for tracing patterns in item production and usage, which are key factors in many glass studies that require accurate vessel counts.

2.4.3 Fragment Weight and Adjusted Weight

Fragment weight can be a quick method of identifying the total quantity of glass in an assemblage, or of the glass from a specific form, while avoiding the problem of breakage, but again, like fragment count, it does not identify the number of vessels present. If a form were so standardised that it was possible to have an accurate average weight, then the total weight could be divided by the average to determine the vessel count, but this degree of standardisation is not the case with Roman glass vessels. The common square bottle (Isings Form 50) (Fig. 2.1), for example, can measure anywhere from less than 10 centimetres to more than 40 centimetres in height, with a body width that could be greater than the height, or less than half the height, allowing for a huge variation in weights for the same vessel form (Isings 1957: 63-66). If, rather than using weight to count vessels, weight is used to compare the total quantities of different forms within an assemblage, it will be skewed toward the heavier forms like serving jugs which will appear to represent a higher portion of the total glass than the vessel numbers would, as opposed to forms like cups (Orton 1980: 161).

Figure 2.1: Isings Form 50 Bottles of varying sizes, and with two different rim-finishing techniques. (Photos: Jonathan Prior with permission of the *Soprintendenza Speciale per I Beni Archeologici di Napoli e Pompei*.).

One proposed way of compensating for the weight of different fragments skewing vessel count in favour of heavier forms is ‘adjusted weight.’ This is attained by multiplying the total weight (g.) of all fragments of one form, by the standard wall thickness (cm.) for that form, and then dividing it by the actual wall thickness of those fragments (Fletcher and Heyworth 1987: 36-37). The adjusted weight method has been shown to produce similar proportions of total assemblages to those of estimated vessel numbers (Table 2.1), but the process can be time consuming in tallying weights and calculating the average thickness of all the fragments of a form, and in doing the research to come up with a 'standard thickness.' When dealing with ceramics, this method over-represents vessels made with a high-density fabric (Fletcher and Heyworth 1987: 36-37). Density is less of an issue with Roman glass, which was quite homogeneous, however, different metals added to colour or decolour different glasses could affect the weights of different samples in a similar way to, and there is no guarantee that the 'standard thickness' selected is, in fact, standard. A 'standard thickness' could easily be influenced by the excavation and recording biases of any studies looked at to get examples of this form. Thin examples of a form may be broken beyond recognition at some sites and may be under-represented giving a standard thickness that is greater than the average actually was when the vessels were whole. Different studies using this method may also calculate different standard thicknesses, skewing any comparison of results between studies.

Table 2.1 Count, weight, adjusted weight, and minimum number figures for three rim types from a sample study of middle-Saxon glass from Southampton. (After Fletcher and Heyworth 1987, Table 3).

Rim Type	Count (no.)	Weight (g)	Adjusted weight (g)	MNI (no.)
Cavity Rims	74 (38.9 %)	135.6 (47.55 %)	67.8 (38.4 %)	42 (35.6 %)
Folded Rims	30 (15.8 %)	35.1 (12.55 %)	20.1 (11.4 %)	21 (17.8 %)
Rounded Rims	86 (45.3 %	110.7 (39.9 %)	88.6 (50.3 %)	55 (46.6 %)
Total	190 (100 %)	281.4 (100 %)	176.5 (100 %)	118 (100 %)

Weight can be useful, in some instances, for comparing vessels of the same type (Cool and Baxter 1996: 95), and for comparing different assemblages, since it is unaffected by fragmentation (*i.e.* the same vessel will weigh the same regardless of how many pieces it is in), and can be useful for discussing fragmentation if it is divided by the fragment count to determine the average weight of sherds (Fletcher and Heyworth 1987: 36, Orton, Tyers and Vince 1993: 169).

2.4.4 Estimated Vessel Equivalency (EVE)

In ceramic studies, EVE is widely used to estimate vessel numbers, but this method is problematic for use on glass. It is frequently possible to identify the type of ceramic vessel by rim or base sherds alone, and the quantity is high enough that body sherds can often be ignored (Cool and Baxter 1996: 97). Researchers can then total up the percentage of the rim and base circumferences for all sherds of the same form, fabric and vessel size, and round these numbers to the next complete vessel. The resulting number is divided by two to eliminate double counting of the same vessel represented by both rims and bases resulting in an estimated percentage of vessels represented. By dividing that number by 100 an estimate of the minimum number of vessels present can be achieved (Orton 1980: 166).

Glass vessels cannot be identified as reliably as ceramics by rim and base sherds alone. Rim and base fragments of glass vessels do not survive as well as those of their pottery counterparts, partly because larger fragments such as the diagnostic fragment types necessary for EVE would be easily collected for recycling, and there are not high enough numbers of glass finds to ignore body sherds with impunity, so counting only one or two types of fragments may greatly underrepresent the quantity of vessels in an assemblage. Furthermore, many glass rim fragments that do survive are so badly broken that it is hard to determine the original curvature and circumference of the rim, which limits the use of the primary EVE technique. Another reason that glass body fragments cannot be ignored is that they may be required to determine the form of a vessel. The same rim finish techniques appear on many different vessel forms, and the same vessel form can have several different finishes. This means that rims are not always useful diagnostic fragments on their own for counting vessels of any one type. For example, the square bottle (Isings Form 50) can be finished with a vertical cracked off and flattened rim (Fig. 2.1: top right), with a horizontal rim that is folded out and either up or down and in, or a triangular folded rim (Fig. 2.1: left and bottom right). The triangular folded rim, or any other of these techniques can also be seen on other vessel forms including cylindrical bottles, flasks, aryballoi, and jugs (Fig. 2.2; Fig. 2.3).

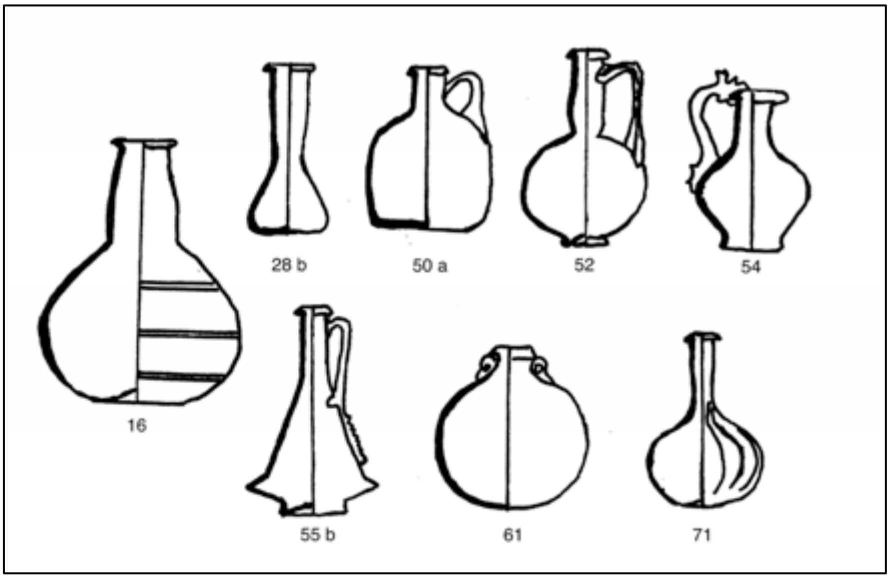

Figure 2.2: Vessel forms with triangular folded rims. (After Isings 1957: 34, 43, 63, 69, 71, 74, and 79).

Figure 2.3: Aryballos, bulbous bottle, and square bottle with the same rim type; all from Herculaneum. (Photos: Jonathan Prior with permission of the *Soprintendenza Speciale per I Beni Archeologici di Napoli e Pompei*.).

Glass also has a great variety in colour and opacity that would have to be accounted for before using any form of EVE. When dividing ceramics for tallying rim circumferences, fragments can be sorted by form and fabric. If the EVE of a bowl form were being determined, then one would gather all the relevant fragments of that form, which can then be split by fabric to ensure that sherds of different colours are not counted as one bowl. Fabric types of Roman pottery are quite well categorised (Tomber and Dore 1998: 4–7) and the colours can frequently be precisely determined using the number coded *Munsell Soil Color Charts* (1992) as well as subjectively, to categorise them accurately. These distinctions can be made quite quickly because of the standardisation and the vast body of work on ceramics. Glass, on the other hand, is more complex. Fragments of the same vessel could appear different as thickness and lighting can impact the appearance of the colour, making it very difficult to identify the colour value in an accurate and reliable manner, even using a set notation system like that derived by Albert Munsell (1975) for consistency in colour description. Aside from colour, one must consider the opacity of the glass, decoration, and finishing technique to distinguish which fragments definitely come from different vessels before tallying up the percentages of those that are more-or-less interchangeable.

2.4.5 Cool and Baxter: Adjusted EVE.

H. E. M. Cool and M. J. Baxter produced a detailed study of the quantification of glass and the application of EVE for the 1995 International Association for the History of Glass Conference in The Netherlands, in which they created their own adaptation of EVE for glass. Their method, which is based on techniques for quantifying bone using a zoning system, attempts to compensate for the relatively small number of glass finds and the inability to discount fragments other than rims or bases. Cool and Baxter decided that each zone of a particular vessel form, be it a rim, shoulder, body, base, or handle, could be given a number value representing an equal portion of a vessel totalling 100 per cent, if all zones are present. When looking at a fragmentary glass vessel, the tally of zones represented is then added to produce a percentage that represents each vessel. Cool and Baxter determined that most forms with no handles can be divided into five zones and vessels with handles like bottles and jugs easily divide into seven (Fig. 2.4). It is important to keep in mind that care must be taken to ensure that each zone present for an individual vessel is counted only once so as not to risk double counting. In a five-zone vessel, for example, in which each zone is worth 20 per cent, a rim fragment and a body fragment would give the vessel a value of 40. If there are two rim fragments and one body fragment only one rim is counted and the number is still 40. All vessel numbers of the same type of vessel are then added up and vessel equivalency is determined as in EVE.

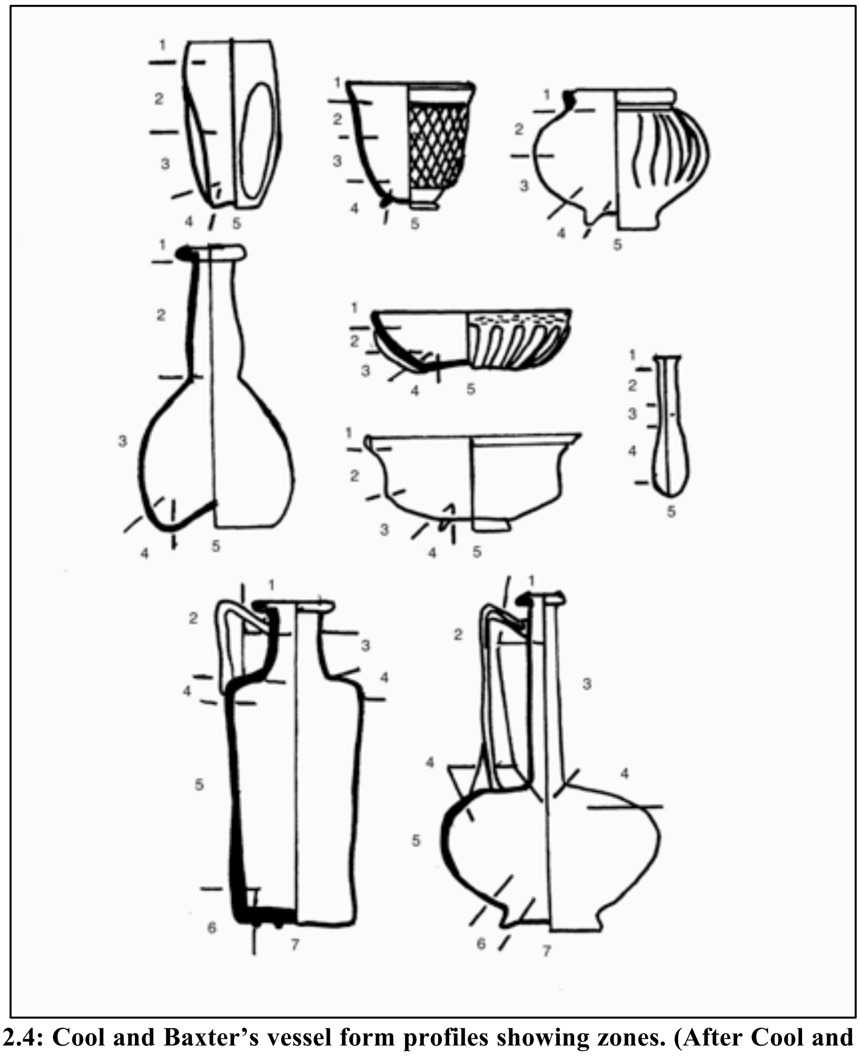

Figure 2.4: Cool and Baxter's vessel form profiles showing zones. (After Cool and Baxter 1996: Fig 1).

This technique is an improvement on standard EVE for glass, but does come with its share of problems. A zoning method must be determined for each form before beginning a study, which can be time consuming at the start, but does not greatly increase cataloguing time after the zones are decided (Cool and Baxter 1996: 97). Another issue is that it can be very easy to count two fragments of the same zone of the same vessel as different vessels if they are not discovered and inventoried together. To ensure the best possible pairing of fragments, multiple variables including fragment size, form, production technique, rim and base finishing, decoration, and colour must be recorded very carefully. Additionally, all the fragments must be studied in the same lighting conditions, because the type of light and the angle of the light on a fragment can change the perception of its colour. A good example of how easy it is to make mistakes based on colours comes from the first century fort on the Kops Hof in Nijmegen, where two natural blue-green fragments of pillar-moulded bowls (find numbers 361/141 and 361/071) are recorded as fragments of the same bowl (van Lith 2009: 19). When examined side by side in the same light, the fragments have different levels of clarity in cross-section, and one has a more greenish colouration showing that, although similar, they are not in fact from the same vessel. A more extreme example of how lighting can change the visible colour of a glass would be the famous fourth-century 'Lycurgus Cup,' now in the British Museum, which can appear either green or red, depending on the light due to nanoparticles in the glass (Fleming 1999: 92; Freestone *et. al.* 2007: 272). Other problems are that fragments of uncertain forms, or of rare forms may be misattributed to a vessel type, or may result in double counting. As a result, the decisions required to prevent double counting and to match vessel fragments, are the very same subjective methods that drive some scholars to prefer EVE above estimated vessel count.

2.4.6 Estimated Number Methods.

The aforementioned problems with Cool and Baxter's method, which requires scholars to match fragments of the same vessel to one another, make it just as simple to tally up the number of vessels represented as to calculate the EVE, because individual vessels are already being identified. In fact, if all the fragments have been sorted by possible vessel connections to as avoid double counting, the Baxter and Cool method should result in identical vessel numbers to an estimated minimum number of individuals count.

There are two basic estimated number methods that can be used. Any fragments that cannot be readily connected to another vessel can be counted as independent vessels, which results in a count of the maximum number of individual vessels represented in the assemblage. Alternatively, unattached fragments can be counted as part of the nearest identified vessel of the same type resulting in a minimum number of individual vessels frequently referred to as MNI.

The maximum estimated number technique tends to over-estimate the number of vessels in an assemblage with numbers that can approach the level of fragment count. Due to the scattered fragmentary nature of glass finds it is easy to find fragments that could connect to others in different contexts that are not readily connected, and the practice of recycling means that pieces that could have physically connected excavated fragments may have not entered the archaeological record at all. This method does not take these facts into consideration, and will result in numerous individual fragments being counted as unique vessels when they may easily have originated as part of the same vessel. As a result, more fragile vessels that break into more pieces, which may be spread far apart and may be represented by fragments that do not connect are over-represented. Looking at the Usk sample in Table 2.2, as an example, one would calculate a maximum number of individual vessels as 33; with 21 Isings 67c and 12 Isings 67b jars. These 33 potential vessels come from a collection of only 51 fragments (not shown in the Table 2.2) and only six of these vessels are represented by more than one fragment. Item 183 was an anomaly in that 12 fragments were found together, but no other example of these two vessel types was found with more than three connecting fragments at Usk.

Estimated minimum number of individuals (MNI) is more likely to provide an estimate closer to the actual number of vessels represented by finds, because it takes into account the problem of fragmentation and strives to avoid double counting and over-representation of more fragile vessels. It will, undoubtedly, under-estimate the numbers to some extent, but its insistence on grouping any unattached fragments to potential matches does draw attention to fragment pairings that may end up being verified under closer study, leading to even more accurate numbers. The two techniques can be useful when combined, because one can use them to create a range of potential vessel numbers between which the actual number will fall. Although MNI calculation using spreadsheets is fairly simple to perform, and can be highly valuable in quantifying an assemblage by actual vessels, the resulting counts are still problematic. MNI methods rely on there being enough suitable criteria to distinguish between vessels, and there is a possibility of over-representing rare or minor types, since many fragments of different common vessels will be similar enough to require them to be counted as only one vessel in a site's MNI (Fletcher and Heyworth 1987: 37). When vessels are largely incomplete, there is a possibility that those that break into more pieces have a higher chance of being represented (Orton, Tyers, and Vince 1993: 169), but with glass, those that are more breakable are often broken into chips so small that they are missed or cannot be identified to the level of a vessel form. This may mean that more durable vessels are more likely to be found, thus making some steps to even out this discrepancy. Even so, it is preferable to look at minimum numbers of vessels represented rather than maximum to prevent more breakable vessels from being over counted.

Nevertheless, Fletcher and Heyworth (1987: 43) argue convincingly that estimated vessel numbers are more meaningful than fragment count or weight because it relates directly to the number of vessels present, and combined with those techniques it provides information about fragmentation and deposition, but there are still concerns about its subjectivity and the ease of over-representing certain forms.

Admittedly, these techniques do rely on subjective analysis, and can be both time consuming and difficult if the assemblage is large and fragments cannot easily be compared to similar pieces of the same vessel type. For this reason, all the care that was necessary to make Cool and Baxter's technique feasible, such as working in consistent lighting conditions, must be taken when analysing an assemblage and recording variables. The use of a multivariable spreadsheet can be of great assistance in accurately pairing fragments that are carefully recorded. The present author makes heavy use of spreadsheets for an estimated MNI technique, which follows the same criteria laid out by Cool and Price (1995: 9), in their catalogue of the glass from Roman Colchester. Every fragment or cluster of related fragments receives an entry in an Excel worksheet with cells for colour; fragment type; vessel type; production method; Isings Form (where possible); provenance; notes on decoration; and where applicable, rim, base, and handle types. Using Excel's filter feature, the entire assemblage can be sorted by vessel type, form, colour, and production method, as Cool and Price (1995: 9) outline, so that all of the fragments that could potentially come from the same vessel can be grouped together (Table 2.2). From this stage one can begin looking at size, fragment type, and find context to identify possible related fragments. Any fragments that can be matched through these filters are then recorded together as a minimum of one vessel, and any that do not match up can be counted as distinct vessels of their form. Once these determinations have been made, the numbers can be tallied up to calculate the MNI for the vessels of each form, or for the entire assemblage.

The example case in Table 2.2, with its limited available variables, allows for a MNI calculation of 22 jars (9 Isings Form 67b and 13 Isings Form 67c). These numbers are reached by eliminating possible connections. Table 2.2 has already been filtered to eliminate all fragments that are not jars, with the remaining fragments sorted by form. Within each form fragment entries are sorted by colour. By then looking at context and diagnostic features within each colour grouping it is possible to determine which fragments must be from distinct vessels and by counting all unique entries as one vessel a MNI estimate can be reached. For example, looking at items 184-187, all the entries are from dark blue Isings Form 67c jars. Three of the entries are at least partly from unstratified contexts from the 1973 excavation. Two of these unstratified pieces connect to other fragments from identified contexts, but these stratified fragments have no markers that rule out the possibility of being from the same vessel either. These three entries, therefore, must be counted as one vessel. Fragment number 186 from is also an unstratified dark blue Isings 67c Jar fragment, which cannot definitively be identified separately from the others in this number range, so based on the information present in this chart the total MNI from this whole cluster must be recorded as one. This table is, of course, a limited data set provided as an example, and with all variables considered, including wall thickness, measurements of the rim fragments and their curvature, and even comments on fragment condition, the MNI could be increased resulting in a number up to the calculated maximum of 33 vessels. This chart does not provide enough data to calculate EVE, but in the selection of items 184-187, EVE methods would calculate and vessel equivalency as one, because only one example of a rim and base is present to examine and items 185-187 would be discounted. Cool and Baxter's method would look at those items, but without conclusive data to distinguish them from 184 theist method would still be discounted so as not to be double-counted with the body fragment in 184, and would also estimate just a single vessel.

Table 2.2: Sample data sheet from the legionary fortress at Usk Wales. Filtered for storage jars and omitting some variable columns.

Item	Context	Vessel Type	Isings Form	Fragment Type	Colour	Manufacture	Rim Shape	Decoration
188	KRW(1) sixteenth century trench	Jar	67c	Body	Yellow-brown	Free-blown		Vertical Rib
191	69 Unstrati-fied	Jar	67c	Body	Light green	Free-blown		Vertical Rib
192	69 RA(1) Flavian fortress pit	Jar	67c	Body	Light green	Free-blown		Vertical Rib
189	69 EP(1) third century ditch	Jar	67c	Body	Yellow-green	Free-blown		Vertical Rib
190	FNL(2) first to second century extra mural road	Jar	67c	Body	Yellow-green	Free-blown		2Vertical Ribs
193	69 RA(1) pre-Flavian fortress pit	Jar	67c	Body	Yellow-green	Free-blown		Vertical Rib
184	73 unstratified; HCM(1) and (2) pre-Flavian/Flavian culvert by *Via Principalis*	Jar	67c	Body Rim and Base	Dark blue	Free-blown	Folded Collar	Vertical Ribs on body. Collar rim is tubular
185	73 unstratified; HON(1) pre-Flavian cistern	Jar	67c	Body	Dark blue	Free-blown		Vertical Ribs
186	68 unstratified	Jar	67c	Body	Dark blue	Free-blown		Vertical Rib
187	73 unstratified	Jar	67c	Body	Dark blue	Free-blown		Vertical Ribs
194	68 FM(1) pre-Flavian fortress pit	Jar	67c	Body	Pale blue-green	Free-blown		Vertical Rib

Item	Context	Vessel Type	Isings Form	Fragment Type	Colour	Manufacture	Rim Shape	Decoration
195	67 BI (13) South Ditch of *Via Principalis*	Jar	67c	Body	Pale blue-green	Free-blown		Vertical Rib
196	65 XIV unstratified	Jar	67c	Body	Blue-green	Free-blown		Vertical Rib
197	69 AF(2) post-medieval stones	Jar	67c	Body	Pale blue-green	Free-blown		Vertical Rib
198	69 NZ(1) pre-Flavian trench of fortress granary B	Jar	67c	Body	Pale blue-green	Free-blown		Vertical Rib
199	69 HX(1) late first/second century pit with residual pre-Flavian material	Jar	67c	Body	Pale blue-green	Free-blown		Vertical Rib
200	69 RE (69 RA) pre-Flavian fortress pit containing material from first through third centuries	Jar	67c	Body	Pale blue-green	Free-blown		Vertical Rib
201	73 unstratified	Jar	67c	Body	Pale blue-green	Free-blown		Vertical Rib
202	LAL(1) pre-Flavian fortress well containing late first century pottery	Jar	67c	Body	Pale blue-green	Free-blown		Vertical Rib
203	LAL(2) Pre/early-Flavian fortress well	Jar	67c	Body	Pale blue-green	Free-blown		Vertical Rib
204	HKP unstratified	Jar	67c	Body	Pale blue-green	Free-blown		Vertical Rib
183	LNA(2)Pre-Flavian pit	Jar	67b	Body	Yellow-brown	Free-blown		
182	Pre-Flavian fortress ditch	Jar	67b	Body and Base	Dark blue	Free-blown		
88	LAL (2) Pre/early-Flavian fortress well	Jar	67b	Rim	Dark blue	Free-blown	Folded Collar	Marvered opaque white blobs on interior surface of the rim.

Item	Context	Vessel Type	Isings Form	Fragment Type	Colour	Manufacture	Rim Shape	Decoration
205	65 X C (4) Antonine pit?	Jar	67b	Rim	Blue-green	Free-blown	Folded Collar	
206	71 unstratified	Jar	67b	Rim	Blue-green	Free-blown	Folded Collar	
207	73 unstratified	Jar	67b	Rim	Blue-green	Free-blown	Folded Collar	
208	69 unstratified	Jar	67b	Rim	Blue-green	Free-blown	Folded Collar	
209	LNA(2) pre-Flavian fortress Pit	Jar	67b	Rim	Blue-green	Free-blown	Folded Collar	
210	DOH(1) early second century ditch	Jar	67b	Rim	Blue-green	Free-blown	Folded Collar	
211	EOM(1) third century drain	Jar	67b	Rim	Blue-green	Free-blown	Folded Collar	
212	FAS(1) above north ditch of *intervallum* road. Flavian and later	Jar	67b	Rim	Blue-green	Free-blown	Folded Collar	
488	69 Unstratified	Jar	67b	Rim	Blue-green	Free-blown	Vertical	Folded over to form a ridge below the rim.

The advantage of using a spreadsheet in this way is that, once individual vessels have been identified, it is possible to back up through the levels of filtering to look at a wide variety of factors, enabling different research questions to be answered. A researcher can look at individual forms or a broader type-category, such as beakers, within the assemblage, calculate numbers of specific fragment types; or can examine the numbers of vessels of a specific production type, colour, or from a specific find context. It is imperative to use a method of quantification that provides accurate vessel numbers (Table 3) and take factors like production method into account when distinguishing between fragments so that accurate ratios can be calculated. The ability to filter by form, colour, and provenance using a multivariable spreadsheet allows for an examination of the role of different production techniques in making utilitarian, or luxury items. All relevant factors can be closely examined, resulting in more accurate estimations of assemblage numbers than can be produced without such close comparison. In the case of the assemblage from the Vetera I fortress at Xanten, Germany, the published catalogue estimated that there were at least 350 vessels (Hanel 1995 a: 250), where close examination found many that could have come from the same vessel resulting in a refined MNI count of 314 as will be discussed in a subsequent chapter. The spreadsheet was invaluable; it would have been impossible to spread out the whole assemblage and compare each piece of the same vessel type side-by-side to see if connexions could be made without a list that could be filtered, otherwise one has to rely on memory to go back and find potential matches.

Not one of the methods presented here is perfect, and each has significant pros and cons, but for set purposes, they can provide us with valuable information about assemblages with which one can undertake further study of glass forms, trade, production, usage, and deposition. EVE and MNI are the best ways to quantify the vessels represented in an assemblage, because they seek to work around issues of fragmentation by avoiding double counting and creating minimum estimates, allowing for studies of seriation and usage alluded to in the introduction. This thesis makes use of the spreadsheet MNI technique discussed above. If a maximum estimated number of vessels is then calculated it will be possible to evaluate the potential for error in calculations and provide a range in which the actual represented vessel count must fall.

2.5 Collection of Data For The Sites in this Thesis

Collection of the data for this thesis was carried out in a series of visits to sites where the glass assemblages were stored. During these visits, it was important to take great care and use the same techniques for handling glass. This study followed the standards of practice laid out by Koob in his book *Conservation and Care of Glass Objects* (Koob 2006: 23-24). The glass was always handled over a table with a clear workspace to minimise chances of damage from drops and to prevent items from being knocked or slid around the table. Any items that did have to be moved from the table were done so in a tray. Vessels were lifted, with two hands, from a strong point below the centre of gravity, not by protruding handles or spouts. This prevented fragile vessels from breaking off under their own weight. All vessels were handled with clean hands to prevent too much transfer of natural skin oils or any abrasion from dirt. Gloves were not worn as their use in glass handling is discouraged unless a specific collector requires their use, etched glass is being handled, or glass with metal attachments are being handled by the metal portions (Koob 2006: 19-20). Gloves limit sensitivity, increase the chances of slippage, and prevent the use of texture in determining whether glass was blown or formed in a mould, which is a key component of this study.

The first assemblage examined was the Usk assemblage stored in the National Roman Legionary Museum in Caerleon, Wales. Access was granted to the full assemblage, including both published and unpublished material, and identification techniques were honed by comparing the author's identifications to those in Jennifer Price's (1995) published catalogue. The assemblage was examined over the course of one week, with as much data as possible being recorded for each collection bag. Each bag, except where separate published items were identifiable, received a separate database entry, which recorded features of the fragments, the number of fragments and the minimum number of vessels. In the interest of speed, information for vessel type, fragment type, colour, manufacture technique, and the types of rims bases and handles were recorded with number codes (Appendix 2), which were used for all the subsequent sites. The mass of each entry was also recorded using a digital balance to avoid missing any data that could be useful, but the unreliability of mass in glass quantification means that this variable was abandoned in later analysis, and does not factor into this thesis.

Analysis regarding find context and comparisons with pottery was carried out after the fact, using the published excavation reports (Greene 1979; Johns 1993; Manning 1989; Manning 1981; Tyers 1993).

The recording system created by Manning for his excavations was problematic and limited the use of contextual information. Feature numbers are made up of combinations of numbers and one to three letters (e.g. 74 MEV (1), ACC, 67 D I, or 67 BII), and these varied over the time span of the excavations. The numbering system has no real way of connecting the feature to the location within the site without tracking down each feature in the publications (Manning 1989; Manning 1981). Some of the feature numbers assigned to the contexts of glass finds are not actually recorded in the publications. There is also no unified map of the site containing all the feature numbers.

The second collection examined was from Nijmegen. Information gathering was improved by extending the period of study to two weeks. Recording was carried out in a well-lit workspace at the municipal archaeologist's office in Nijmegen. Identification was again assisted by the presence of a published glass catalogue (van Lith 2009), which contained the majority of the assemblage. Feature types were still in the process of being catalogued at the time of this visit, and have yet to be made available for study. This site has no published report, or unified catalogue of the ceramics so it is the one case study in which there can be no comparison of vessel materials.

Before undertaking the study of the Xanten assemblage, many parts of the database were compiled from the detailed catalogue produced by the Norbert Hanel (1995b). More time could, therefore, be spent examining each find in a two-week period of study at the storage depot for the Rheinisches Landesmuseum in Bonn, Germany. The added time allowed for close checking of Hanel's identifications, and better use of photography in recording the collection. Photographs were taken on a white backdrop using a digital camera stabilised on a tripod. In a few cases a photo apparatus was used that suspended the camera between lights directly above an object, but this was found to cause too much reflection off the glass fragments so was abandoned in favour of the tripod and simple use of the room's lighting. Work was carried out in a well-lit office space in which the blinds remained closed to keep the light conditions the same throughout the course of the day. The storage and organisation of this assemblage was of great assistance in recording the site, as each separate vessel identified by Hanel was collected in a separate box.

The final full assemblage study was carried out at the site offices at Herculaneum. Four weeks were budgeted for the study, and materials were recorded in the same way as they had been at Xanten. Vessels were recorded in the mornings, as it is required for a member of staff to be present with researchers at all times while materials are being handled. In afternoons, work moved to the site offices of the Herculaneum Conservation Project where further information on find context and publication information was collected from an unpublished find index of all materials from the modern excavations at the site, which was made available by the staff (Siano Unpublished Catalogue).

Pompeii was studied differently. Results were recorded in the same way, but it was a limited sample study, for which only vessels that could be associated with a specific find context were examined. There was no unified catalogue of finds with which to work and it was, in most cases, impossible to select certain buildings and social contexts and to study all the glass from each. The time period allowed was two weeks, but the assemblage was not available for the entire time and the storage of the assemblage made access complicated. The lack of a site index meant that time was spent at the library of the National Archaeological Museum in Naples in order to identify collected vessels that had context information. Very few of the items in the museum assemblage had context information, so access permission had to be obtained to view materials still stored at Pompeii. Two days were spent on-site at the excavation where materials from known contexts in Region I were examined. The limits of this study and the difficulties encountered mean that the majority of the data used for the Pompeii discussion is from a study by De Carolis (2004) rather than from direct analysis.

2.6 Making Use of the Data

The data collected from the research trips has been divided into four case-study chapters that catalogue the vessel types present at each site in sections based on production type. By identifying the vessel types present at each site, as well as the colours and decorations incorporated into vessels, it is possible to determine how glass was being used and come to conclusions about the status of glass. Cool and Baxter (1999: 85) have argued that naturally coloured blue-green glass, which is by far the most common colour found on first-century sites, has no reason to be present if not for use, and that vessels of these colours were utilitarian rather than luxury. The case studies presented here will seek to identify forms of strongly coloured vessels and multi-coloured cast vessels that would have been time consuming to produce and would have required extra colouring agents. Where possible, the distribution of cast and blown forms across each site will be identified to see if any forms or production types are most prevalent in contexts that would be considered wealthy, thus identifying the vessels as luxury items.

The nature of excavation and publication presents limitations on distribution studies. Most suitable forts and towns that are not hidden beneath later towns and are readily identifiable in the landscape, allowing for large scale open plan excavation, were excavated in the 19^{th} and early 20^{th} centuries. Excavations of these times often lacked careful comprehensive recording of context information, although German sites, like Xanten, do have a fairly long tradition of good recording (Allison 2013: 54-55). Older excavations also lack suitable GPS coordinates for GIS analysis and mathematical pattern recognition. Allison argues, however, that excavations with ideal conditions are often too limited for detailed finds distributions, and computer recognition leads to unjustifiable precision that misrepresents distribution over whole sites. She instead recommends 'eyeballing' as a technique, which is used for the relatively small assemblages that can have objects pinpointed on maps in this thesis (Allison 2013: 46-47). While it is impossible to be certain that many finds plotted on site maps are *in situ*, the fact that most buildings and spaces, particularly in forts, were not paved, increases the chance that lost or broken items would be trodden into the ground and found close to their point of use. Furthermore, refuse pits were common throughout military bases, meaning there would have been little need to discard items far from their place of use if they were collected after breakage (Allison 2013: 52).

Each chapter first outlines a brief history of the site and how it is significant before documenting the minimum number of vessels present in the assemblage in sections arranged by production method. For each case-study there is then a discussion of patterns within the site, looking at the types of glass vessels that were in use, the roles that they likely filled in each social context presented, and where possible, the distribution of glass vessel use and their relation to ceramics and metal ware. A cross-site analysis chapter will then look at potential patterns that can be seen across the broader context of the early Roman Empire to look at the spread of glass use, and the prominence of different production techniques in different social contexts. This evidence can then be used to strengthen our understanding of the spread of glass across the Empire in the early years of glassblowing, and to better evaluate the role of glassblowing in this spread.

Chapter 3 : Usk: Pre-Flavian Fortress Glass on the Western Frontier.

3.1 Intro: The Site

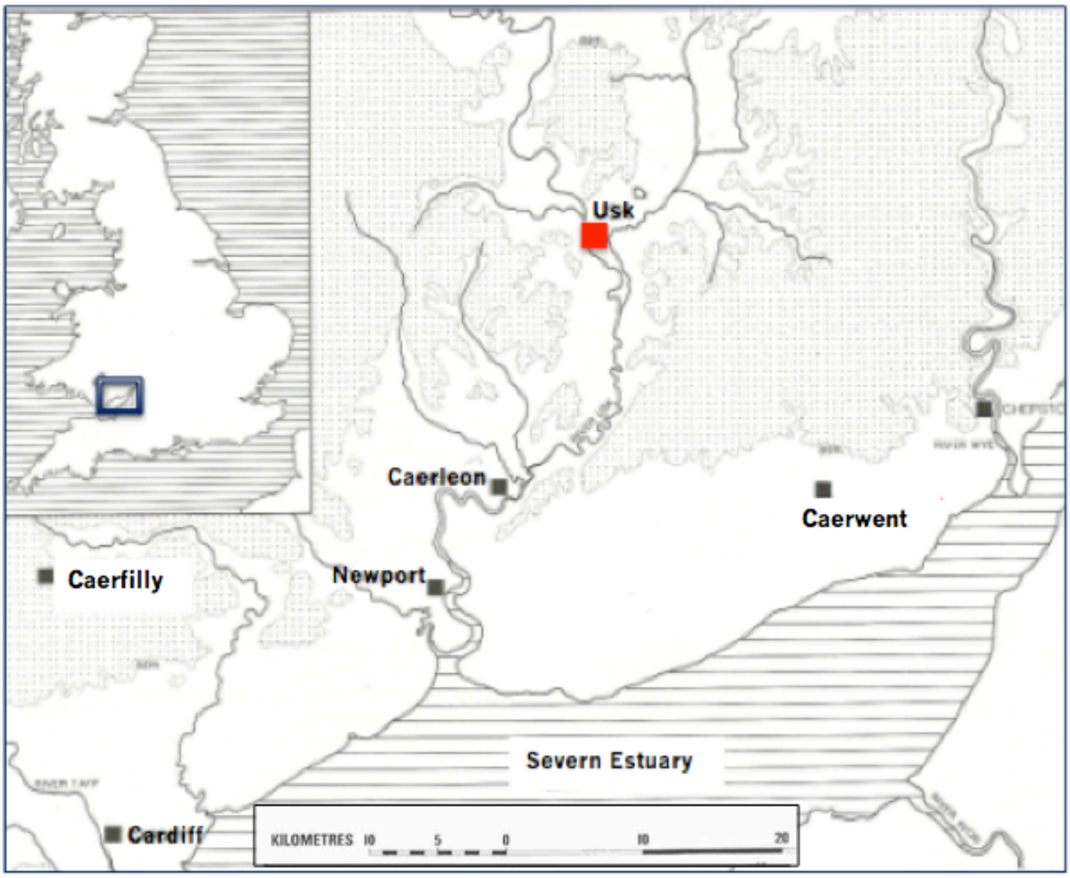

Figure 3.1: Location of the Usk fortress (After Manning 1989: vi)

The town of Usk stands on the site of one of three Roman legionary fortresses that were constructed for the pacification of what is now Wales. The Roman fortress was built on a low plain near the junction of the river Usk and Berthin Brook (Fig 3.1), and next to the Olway Brook at a point where it could control trade and transportation from the coast up through much of Wales and South-western England (Fig. 3.2) (Manning 1981: 4-5). This was the midway point between Abergavenny and the estuary of the river at Newport allowing for quick access to these locations along the river valley, and also along the Olway, to Raglan and then on to Monmouth (Manning 1981: 53). Despite its strategic location, Usk only served as the Roman base in the region for a relatively short period in the first century A.D. before being replaced by the fortress of *Isca*, at modern day Caerleon. Despite, and perhaps because of, its short occupation, Usk provides a wealth of material from the period immediately following the conquest of Britain in A.D. 43 leading up to the Flavian period of A.D. 69-96.

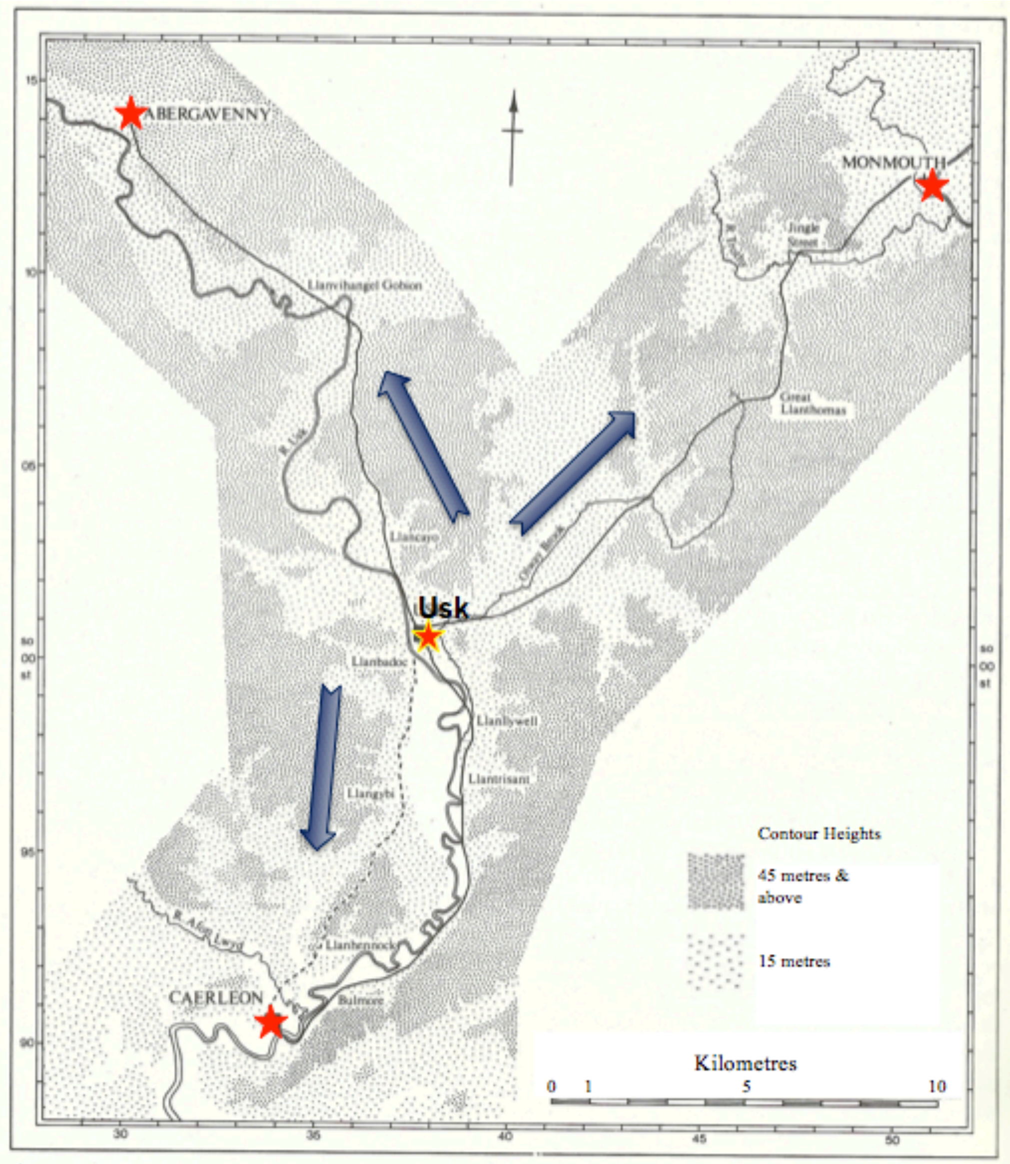

Figure 3.2: Trade routes from Usk (After Manning 1981: 56).

3.1.1 Period of Occupation

The precise foundation and abandonment dates of the Usk Fortress are not known. It could have been founded in any of the campaigns against a local tribe known as the Silures,[27] recorded in Tacitus' *Annals* XII.31-40 and XIV.29, and *Agricola* XIV[28] placing the earliest possible foundation date in A.D. 49[29] (Manning 1981: 31). The numismatic evidence is fairly poor in the region, and consists of a mixture of genuine Claudian coins, Claudian copies, and relatively unworn later coins of Nero. The small number of genuine Claudian coins minted late in his reign, and the absence of Neronian coins predating his issue of A.D. 64 suggests an early Neronian foundation date, occurring after the Claudian coins stopped being produced but before many Neronian coins arrived in Britain (Manning 1981: 32). Pottery evidence seemingly supports the Numismatic dating of the Usk fortress. The Samian pottery from the site and Hartley and Dickinson's identification of pottery stamps leaves little doubt that the fortress was in operation in the early years of Nero's reign, and it was definitely functioning by A.D. 60 (Hartley and Dickinson 1993: 207-218; Manning 1981:32-33). Based on these arguments, the absolute latest date for the fortress' foundation lies between A.D. 58 and 61 under the command of Veranius or Suetonius Paulinus (Manning 1981:32-33).

The demolition period is more securely dated. Pottery evidence from Manning's excavations suggests that demolition occurred in the early 70s A.D. Samian ware from

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[27] The Silures were the dominant native tribe of south Wales who controlled all the lands west of the Severn and the Dee rivers. (Morgan 1856: 5; Manning 1981: 15). They are believed to have been the tribe described by Tacitus in *Annals* 12.31, who in *circa* A.D. 47 crossed the river Severn and attacked the territory belonging to another local tribe of the Dobunni who had treaties with Rome. This was the catalyst for the new governor, Ostorius Scapula's military campaign. (Barrett 1979: 538)

[28] Campaigns against the Silures were led by Ostorius Scapula, Quintus Veranius, or Suetonius Paulinus (Manning 1981: 31).

[29] Four Legions were present in Britain at the time (Southern 2011: 59; de la Bédoyère 2010: 108), but there is little local evidence to identify the legion that founded Usk. The only possible evidence found in the archaeological record at Usk was a single bronze roundel bearing the crest of *Legio XX* (Manning 1981: 38-39). The only other evidence to support *Legio XX* as the founding legion comes from elsewhere in the form of evidence for other legions being Located at Exeter (*Legio II*), Lincoln (*Legio IX*), and Wroxeter (*Legio XIV*). *Legio XX* was stationed at Colchester immediately after the conquest and would have been available to come and deal with the Silures (Manning 1981: 38; Southern 2011: 81, 86).

the latest pits inside the fortress and from the north culvert of the *via principalis* provide much of the support for this dating (Table 3.1). The culvert would have originally been covered, and its stone covering slabs would have only been removed during the last stages of the demolition. Once the covers were removed, rubbish could be thrown into the culvert on top of the silt that built up while it was in use, and the pottery found among this rubbish almost entirely consists of Flavian, rather than Neronian wares. The few older pieces likely represent residual pottery (Manning 1981: 47). When looking at Samian stamps used to date Usk, we can be confident that the main occupation ended in the early 70s A.D. because 71.9 per cent of all the Samian stamps found at the site date to before A.D. 80 and 60.9 per cent of all Samian stamps date between A.D. 50 and 70. No decade between A.D. 80 and A.D. 200 is represented by more than 4.2 per cent of the stamps (Tyers 1993: 128, Table 2).

The Usk fortress would certainly not have remained in use for long after *Legio II* Augusta founded *Isca* at Caerleon. There was no need for two legions to be stationed only eight miles apart (Manning 1981: 45), making the Usk fortress redundant, and despite its strategic position, it was limited geographically by hills and prone to flooding, making the Caerleon site preferable (Usk Civic Society 2010). The foundation date of *Isca* is situated *circa* A.D. 74, under the governorship of Julius Frontinus, who served from 74 to 78 (Boon 1972: 18). These dates can serve as a reliable end point for the intensive occupation of Usk.

Table 3.1: Samian pottery forms at Usk (Tyres 1993: 127)

Source Catalogue	Form Number	No.	Per cent of plain wares
Dragendorff	15/17	259	10.16
	16	1	0.04
	18	557	21.86
	18/31	290	11.38
	31	194	7.61
	22	4	0.16
	23	2	0.08
	24/25	172	6.75
	27	643	25.24
	33	131	5.14
	35	18	0.71
	35/36	5	0.20
	36	27	1.06
	38	50	1.96
	42	1	0.04
	43	1	0.04
	44	3	0.12
	45	43	1.69
Ritterling	8	13	0.51
	9	10	0.39
	12	99	3.89
	13	4	0.16
Curle	11	5	0.20
	15	2	0.08
	21	8	0.31
Walters	79	3	0.12
	80	1	0.04
	81	1	0.04
Ludowici	Ts	1	0.04
Total		2548	100.00

3.1.2 Significance of Usk to this Thesis

The dating of Usk's Roman occupation makes it a useful site for this study. Usk has a substantial glass assemblage that has been catalogued by Jennifer Price, who was available for consultation, making this a perfect first site for study. Price's study is primarily a catalogue and summary of glass forms, but there is little discussion of the use and status of the vessels, and there is no comparison of the whole assemblage to other sites. This study will situate Usk within the context of the first-century Roman world, and in the cross-site comparison chapter Usk's glass will be compared and contrasted with the other military and civilian assemblages, allowing for an understanding of the role of the Usk glass.

The detailed catalogue and availability of Professor Price allowed for this study's identification methods to be checked for accuracy and developed for the studies that follow. The occupation of the Usk fortress falls into a period almost exactly one century after glassblowing was invented, allowing us to see how far glass use had expanded in that time and to evaluate the level to which casting techniques had continued to spread to newly conquered territories that had almost no glass before the arrival of Romans. If glass casting was restricted to the production of luxurious, eastern goods, and was substantially slower and more expensive than blown glass, one would expect that there would be very little on a military site at the western edge of the Empire. It would seem probable that pieces present would be decorative imports, with the utilitarian portion of the glass assemblage being composed entirely of blown glass. The size of this assemblage and its detailed publication, along with its limited date range, allow for a good comparison of the proportions of cast and blown glass in use during the occupation period. The ratio of production methods along with the types of forms present will be used to evaluate the status of cast glass.

Due to the nature of the fortress' decommissioning, few fragments were found in use contexts. The majority of finds come from fortress rubbish pits, trenches that were filled in during the dismantling of the fortress, or in loss contexts such as latrine pits. Loss and rubbish pit contexts can often be interpreted as close to the location of use, but finds from fortress ditches are more difficult to interpret. Furthermore, Manning's trench labelling system comes across as arbitrary making it challenging to situate many trenches within the fortress, in many cases rendering even rubbish pits difficult to situate in relation to buildings.[30] As a result, the physical distribution of the finds cannot be relied upon to a great extent for identifying the status of vessel ware, so colour and form are particularly important. We must also consider that during the fortress' decommissioning, undamaged high status wares would likely have been removed, so the remaining material may underestimate the presence of high status material within the fortress, but it is possible to evaluate the remaining cast and blown material to determine whether or not vessels had to be blown to be widely affordable.

As vessel numbers from Usk will suggest, glass was widely available to the army (Price 1993: 67), and its short 20-30 year occupation means that it does not pose problems of confusing glass of many irrelevant time periods. The short occupation period may also have limited the opportunity for vessels to go through cycles of breakage and recycling before the site was abandoned, leaving a record of what was there at that time. There are no problems with residual pre-Roman glass, as the fortress was constructed on previously unoccupied land, and there was little occupation of the site between the Flavian and the medieval periods. Even then, the medieval castle was positioned on the heights overlooking the modern town rather than on the Roman fort site (Manning 1981: 56-58). The medieval and later settlement in the region did contribute a substantial amount of glass to the site, but the forms and quality frequently distinguish this glass from the Roman material. As Price and Cottam noted in their 1998 handbook on Romano-British glass vessels, Roman glass generally survives in good condition due to its composition, which readily distinguishes it from medieval glass. The medieval glass contained a potash flux, rather than a soda flux, the former of which decays in the ground and results in pitted surfaces with opaque weathering (Price & Cottam 1998: 4). As a result, we can easily, in most cases, distinguish the Roman glass

[30] Manning's labelling system generally contains the final two digits of the year followed by either a two or three letter label that does not seem to be organised on any coordinates grid. Some of Manning's trench identification labels cannot even be found in the volumes that record his excavations.

from more recent glass and determine that the majority of Roman glass discovered at Usk dates to pre-Flavian or, at the latest, Flavian Roman Britain.

Being situated in a new province, that had not enjoyed common glass vessel use before the Roman conquest, fortresses like Usk were a long way from known production centres, but soldiers would have needed tableware and the high occupation densities at fortresses would have made them targets for traders (Price 1993: 67). Traders would have followed the army, and one must remember that the army itself would have included specialist craftsmen (Cool *et al* 1999: 147), so it is possible that soldiers produced some of their own glassware. There have been glass-melting pots, raw ingredients, and trails and blobs of glass discovered near the Roman garrison at York (Cool *et al* 1999: 147-149), which suggests that soldiers or camp followers, in Britain, may have been involved in glass production. Furthermore, it is already known, from Greene's identification of the locally produced 'fortress wares' from the Usk fortress itself (Greene 1993: 3-124), that fire-based industries were active at the Usk fortress site.

Due to the limited Roman occupation of the site following the closure of the fortress, and the relative ease of distinguishing between Roman and medieval glass, most of the Roman glass here can be fairly confidently dated to the Neronian and early-Flavian period. The demolition of the Usk fortress and lack of subsequent Roman occupation may also help to mitigate the impact of recycling on the glass numbers. The fortress may not have been in use long enough for much of the glass to go through the cycle of being broken, collected, and recycled, as is typical of sites with a short occupation such as early military sites (Cool & Price 1995: 7).

3.1.3 Criteria Examined

There have been several periods of archaeological investigation at Usk,[31] but none as comprehensive as the excavations carried out by W. H. Manning and R. P. J. Jackson between 1965 and 1975. Since these are the most substantial studies of Roman Usk ever carried out, and since material from earlier excavations has largely been lost (Manning 1981: 7-11), the focus will be on the material collected in Manning's excavations. Over 2,100 fragments of vessel glass were found during these excavations as well as 270 other glass objects and 49 fragments of window glass (Fig. 3.3) (Price 1995: 139).

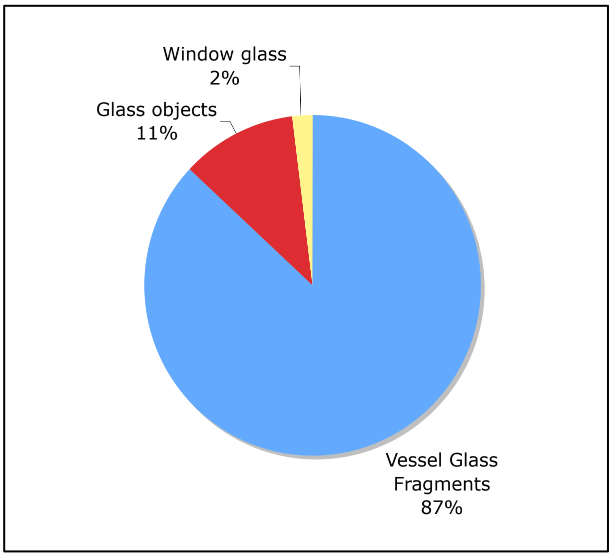

Figure 3.3: Types of glass finds from Manning's Usk excavations (using data from Price 1995: 139).

Of the vessel glass, which is the concern of this study, at least 1,431 fragments, all in the possession of the National Roman Legionary Museum in Caerleon or the National Museum of Wales in Cardiff, are of Roman origin and of a relevant date range (40s to late 70s A.D.). The excavations uncovered very few glass forms introduced in the late first century or the second century, and there is no glass that has been identified

[31] Most explorations were carried out by surveyors or chorographers but an addition to the gaol, in 1856, unearthed remains, and A.D. Berrington conducted a series of excavations in 1877-8.

as late third or fourth century (Price 1995: 139), but there is a large quantity of medieval and modern glass.

3.1.4 Methodology

When analysing the Usk assemblage the first task was to distinguish the Roman glass from the post-Roman, all of which is stored together. The post-Roman glass was set aside, and the remainder was examined for its texture and form to determine production method and function. This study then groups the various vessel types represented, and discusses them in terms of the percentage of the glass assemblage that they represent following the practices outlined in the previous chapter.

The published glass in this assemblage is bagged and recorded individually with publication information on each bag to allow it to be quickly checked against Price's catalogue. The unpublished material at this site was gathered in large bags with little to no detailed context information, and no distinction between glass of different vessels or time periods. In the initial recording, each 'item bag' was its own entry in a master database and had a minimum number of vessels noted for that bag. An initial total of 1,431 Roman vessel glass fragments, which represented up to 750 vessels, was drawn from these entries. This preliminary count, however, did not take into account the possible distribution of multiple fragments from the same vessel over multiple contexts, excepting a few cases where notable diagnostic features showed related fragments. These are noted in only about three to four per cent of 649 item bags and several of them are from the same context. In order to organise the raw data and identify fragments from the same vessel, it was necessary to produce spreadsheets for each colour of glass. It was then possible to sort out and record the forms of each vessel type that were represented in each colour group. From this, an estimated number of vessels of each form could be reached by looking at fragment types, just as Cool and Price (1991: 9) suggest.

Cool and Baxter's article on quantifying glass assemblages (Cool and Baxter 1996: 93-101) had not been discovered when this collection was examined, so the vessel zones are not recorded in the same way as the other case studies (Appendix 3). Cool and Baxter's zone tallies could not be recorded for this site, but in the case of Usk, most vessels appear to be represented by single fragments, and so division by colour and form should provide relatively accurate numbers of the vessels present in the excavations. The vessel numbers obtained for this site are purely based on observations of the sort outlined in Cool and Price's (1991) Colchester report. All vessels of the same colour and form were then checked against one another based on decoration, type of fragment, and, where possible, size and context to determine whether or not they could have been from the same vessel. Through this filtering system a reasonably accurate count of the number of vessels represented in the Usk assemblage has been produced (Appendix 3: Usk Sheet).

3.2 Types of Glass Production

The glass at Usk covers a relatively wide number of forms in the range of tableware, toilet containers, and household storage containers. These items constitute one of the largest Neronian to early-Flavian assemblages of vessel glass that is documented in Britain (Price 1995: 139).

In order to discuss and quantify the types of vessels present in an organised manner, this study is divided up by production type. Cast glass, which makes up around five per cent of the vessel glass, is discussed first. This is followed by blown glass; divided into the sub-categories of mould-blown (0.5 per cent), and free-blown vessels (94-95 per cent), although there is always some overlap, especially when considering square and cylindrical bottles, which can be produced either by free- or mould-blowing. Depending on the bottle fragment it is not always possible to state definitively which production method was used. For the sake of discussing the form as one, all of the bottles are discussed within the free-blown sub-section.

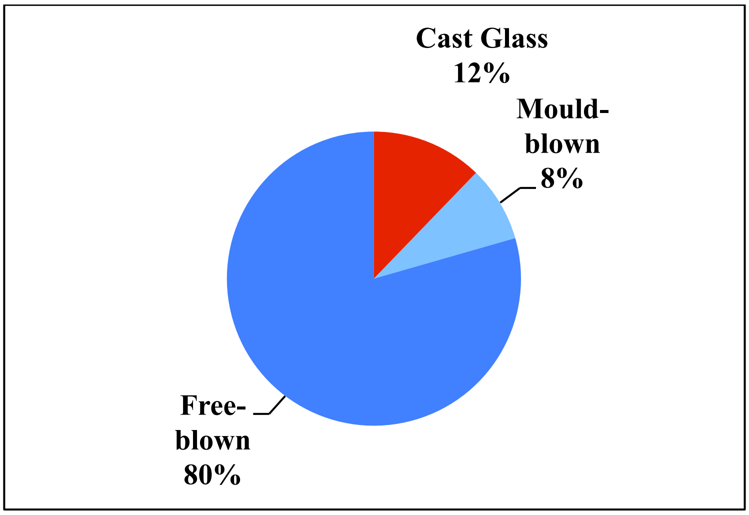

Figure 3.4: Percentage of vessels by production type.

Each production-type section highlights the general vessel types present, such as cups and beakers, bowls, plates, jugs, unguentaria, *amphoriskoi*, flasks, bottles, jars, and then vessel fragments with no recognizable form, and then identifies specific forms according to Isings typologies (Isings 1957). After summarising the material that is present, the glass assemblage as a whole is discussed. The numbers of vessels from each production type and vessel form are compared to better understand the glass industry as represented at Usk.

3.2.1 Cast Glass

The examination of the Usk vessel glass assemblage (Appendix 3) clearly shows that cast glass is in the minority, representing only 12.2 per cent of the total glass assemblage, and cast vessels are only represented in four forms. None of these have any features to suggest that they are inherently luxurious, although elements of colour and decoration may allow for some to be interpreted as at least somewhat decorative, albeit functional vessels.

Table 3.2: Cast vessel forms at Usk.

Vessel Type	Description	MNI	Date Range
Pillar-moulded bowl Isings Form 3 (Appendix 1.A.3)	Thick-walled bowl with pronounced, vertical ribs	73	First century B.C. – early second century A.D.
Small bowl or cup (no identifiable form)	Thick dark blue walls	1	Mid-first century (Claudian)
Plate or shallow dish Isings Form 5 (Appendix 1.A.5)	Dark green with vertical base ring	1	Second half of the first century A.D. (Isings 1957: 21)
Unidentifiable possible core formed vessel	Badly worn fragments with possible rib	1	N/A

3.2.1.1 Pillar-Moulded Bowls (Appendix 1.A.3)

The vast majority of cast fragments fall into the pillar-moulded bowl category, identified as ‘Isings Form 3’ in Clasina Isings’ 1957 doctoral thesis (17-21). This form is readily identifiable due to its prominent vertical ribs, which terminate shortly before the rim leaving an undecorated, but often ground band around the top. Isings Form 3 fragments have been identified in 83 of the 649 different collection bags encompassed in this case study. In contrast, only three to five collection bags contained fragments identified as cast in other ways.

The pillar-moulded bowl was common in Britain from the Roman conquest right through the first century A.D. and some blue/green vessels of the form were in use into the early second century (Price and Cottam 1998: 44). The bowl serves the same functions as many other forms of glass and ceramic bowls or cups and, depending on the size, this form may have been a drinking, eating or serving vessel. Cool and Baxter argue that these bowls were likely drinking vessels, noting that their numbers drop off in the second century as other drinking vessels such as beakers and small cups rise in prominence. If this change was just due to the relative cheapness of blown glass and its demand among poorer classes it is reasonable to expect that this change would have occurred earlier in the first century. Since it was such a late decline for the pillar-moulded bowl, Cool and Baxter suggest that the decline came about due to cultural change and a change in drinking habits, wherein people shifted from the use of communal drinking vessels to the use of individual cups and beakers, or a decrease in the volume being drunk at one time (Cool and Baxter 1999: 81). This pattern can be seen elsewhere in Roman Britain. One example given by Cool is in Colchester, where pillar-moulded bowls were abundant in the pre-Boudiccan levels, and small cups and beakers are virtually non-existent until after A.D. 61 (Cool 2006: 178). Some changes in drinking patterns may have been foreshadowed within military sites, as Colchester's barracks blocks contained many pillar-moulded bowls, but the high status officers' houses had relatively few (Cool 2006: 178). This immediately flags up problems with the argument that cast glass was more costly than blown-glass, since the most prominent cast form is found in lower-class settings more often than higher-class ones. This form is also notably more prominent in military sites than in civilian sites, as Cool noted at the forts at Castleford and Colchester, relative to Ladenhall Court in London, again suggesting differences in habits, or that the mobile military valued thick-walled durable vessels (Cool 2006: 182, 188).

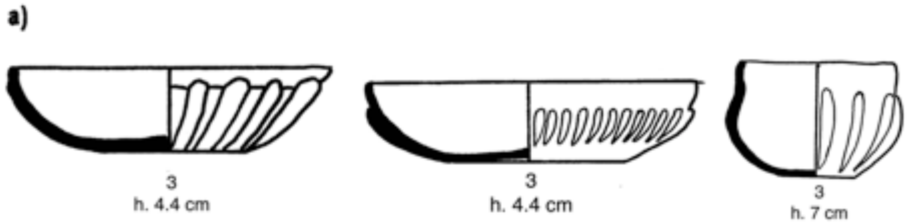

Figure 3.5: Isings Form 3 variants (After Isings 1957: 18-21).

Table 3.3: Isings Form 3 colours.

Colour	Number of Fragments	MNI Vessels
Green Polychrome	3	2
Blue Polychrome	6	1*
Dark Amber/Brown	4	2
Amber	1	1
White	1	1
Colourless	24	1
Dark Blue	19	7
Light Blue	3	1
Blue-Green	87	57
Totals	**148**	**73***

* Five of the dark blue fragments are likely from different vessels, and could raise the MNI

The Usk assemblage challenges the idea of cast glass being inherently more costly and luxurious than blown glass because the pillar-moulded bowl is actually the best-represented individual form at Usk.[32] Form 3 is represented by 148 fragments,[33] in 83 collection bags. Even when looking for matching contexts and vessels with the same colour and type of decoration, there appear to be between 66-79[34] individual vessels. The actual number may be toward the higher end of this range because, while items 82.10H/1, 82.10H/2, 82.10H/3, 82.10H/4, and 82.10H/5 are all similarly decorated and coloured polychrome body fragments (Price 1995: 142-143 Nos. 1-1d, Fig. 42), they all come from different features and could represent up to five different vessels that were broken and discarded at different times. Their contexts include a pre-Flavian cobbled surface, with an associated fragment in a pre-Flavian fortress pit; two separate fortress

[32] It is possible that some other vessel forms were present in higher numbers but if fragments have no diagnostic features it is not possible to make a connection to a specific form. This estimate comes strictly from the numbers of vessels to which the author, or Jennifer Price could assign a form.
[33] Price's publication records 106 fragments, which represented about 5 per cent of the vessel glass she studied at Usk (Price 1995: 140)
[34] The minimum number of 66 is only possible if some of the colourless chips found with pillar-moulded fragments are also part of the pillar-moulded bowl 82.10H/9 (Price 1995: 145 Nos. 5 and 5a.

rubbish pits (one pre-Flavian and one Neronian-Flavian); a fortress closure pit; and a pre-Flavian charcoal area (Price 1995: 142-143). These contexts were, however, mostly concentrated in the western area of the fortress near what has been identified as an officer's house (Figure 3.6, house 1), which may indicate that the polychrome cast bowls are among the few identifiable 'luxury' wares from Usk. The outlier, fragment 82.10H/4 (Price 1995: 143, No. 1c), came from an area of charcoal belonging to the early period of the fortress about 200 metres southeast of the other fragments (Price 1995: 142).

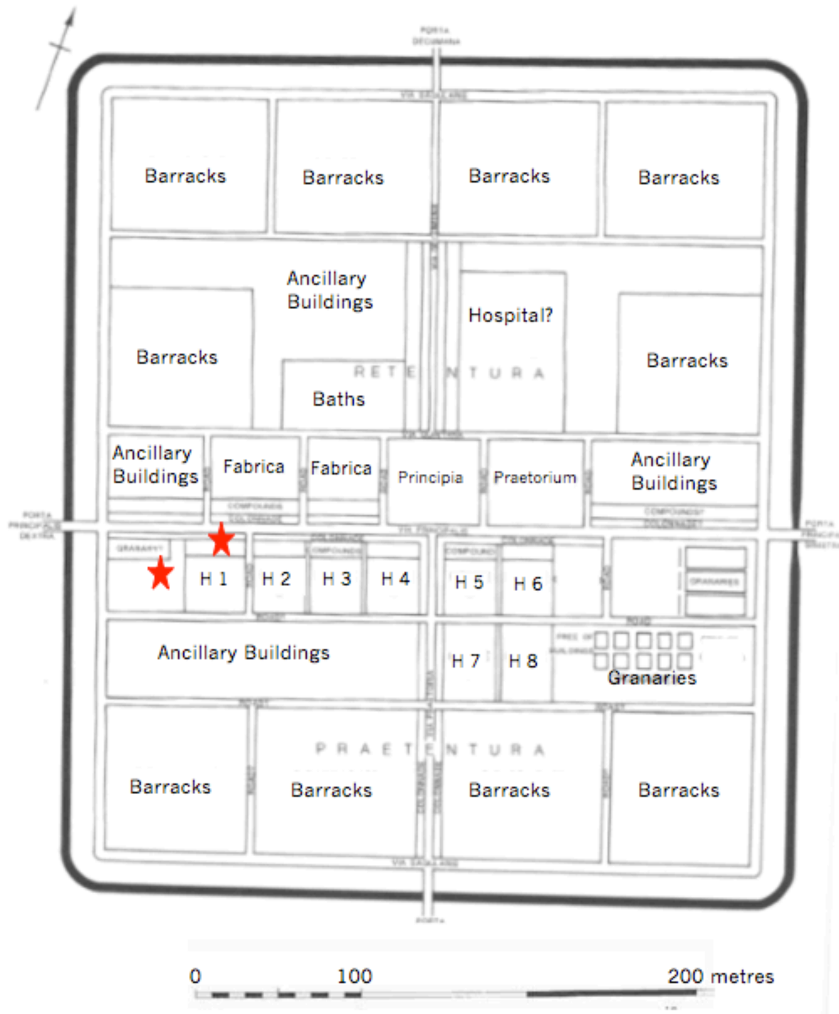

Figure 3.6: Proposed fortress plan. Blue polychrome fragments were found in pits in front of and to the west of house 'H 1.' (After Manning 1981: 164, Fig. 71).

In addition to the six polychrome fragments, mentioned briefly above, there are three (only two of which are published) fragments that have a dark green ground. The polychrome pillar-moulded bowls are notable here because they are rare in Britain except for at sites that had intensive occupation immediately following the Claudian invasion, such as Colchester (Harden 1947: 289, 294).[35] These would almost certainly have been more costly than plain coloured vessels, since they required the production, arrangement, and fusion of the individual canes of each colour, before even beginning to form the final vessel. This would not have allowed rapid, cheap production of vessels, suggesting that these would have been costly luxury items rather than mass-produced utilitarian vessels available to regular people. The pattern of white clockwise spirals around yellow centres on a blue field, seen in the fragments at Usk are yet more rare, with only one such fragment known from Brandon Camp, in Herefordshire (Price 1987: 72-74, No. 1). To find other comparable vessels one must look to contemporary sites in the Rhineland, such as Valkenberg where blue, white, and yellow examples are known (van Lith: 1979: Nos. 22 and 28). The presence of such vessels at Usk suggests that luxurious items like these were desired as supplements to the large body of utilitarian items of this type.

While not as obviously utilitarian as naturally coloured blue-green glass, solid colours would not have been overly difficult to produce, and they are common enough throughout the early- to mid-first century, including in military barracks, that one can assume that they were available to more than just the richest of people. Solid coloured glass, often translucent but sometimes opaque, was more common in Romano-British cast vessels than polychrome or colourless glass. The most common added colours are dark blue and yellow-brown (Price 1995: 145).

Eleven different inventory numbers contained examples of solid-colour pillar-moulded bowls at Usk. Among these are at least seven different dark blue bowls (Price

[35] Polychrome pillar-moulded bowls have also been noted at Richborough, Fishbourne, and the fortress that replaced Usk at Caerleon, (Bushe-Fox 1932: 84-85, No. 59; Harden and Price 1971: 326, No. 3; Nash-Williams 1932: 92, No. 15; Price 1993: 68).

1995: 146-147, Nos. 7-7f), and one light blue example. Two fragments are a dark yellow-brown colour, and they are almost certainly separate vessels due to the finishing. One of these yellow-brown fragments (82.10H/11; Price 1995: No. 6) is from a thick-walled bowl with large coarse ribs and very little of the commonly seen grinding on the rim.[36]

The most common colour of pillar-moulded bowl at Usk is, unsurprisingly, natural blue-green. Naturally coloured pillar-moulded bowls are almost always present in early to mid-Flavian assemblages, but a few do appear into the early second century (Price 1995: 147). Price has published all but four of these fragments collected at Usk. The 58 published blue-green items (74 fragments in total) are all recorded in Price as numbers 8 to 21a-f and while it is not possible to be completely certain, there appears to be a minimum of fifty individual bowls. Fragments that were omitted from the initial publication bring the MNI up to 54.[37]

Since almost all of these vessels are represented by single fragments, and there are few joining fragments, it is likely that there was some collection for discard elsewhere, or recycling. While no glass furnace has been identified, there were six examples of glass slag in the assemblage, which hints at local glass production that would utilise recycled material. It is possible that a glass furnace was destroyed or overlooked, or that it was located in an unexcavated part of the fortress of which only about 45 per cent has been excavated (Manning 1981: Fig. 1).

Most of the recorded pillar-moulded bowls have secure pre-Flavian or Flavian contexts but there are a few contexts that fall outside this period. While the fragments in

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[36] A lack of finish in amber-brown bowls has been noted at Fishbourne (Harden and Price 1971: 330 No. 21), Kingsholm (Price and Cool 1985: 45 No. 3), Sea Mills (Cool and Price 1987b: 95, 97, No. 1), Carlisle (Cool and Price 1991: 165, 169, No. 622), Colchester (Cool and Price 1995: 19, Nos. 7 and 9) and Wroxeter (Price 1995: 146). Price suggests that these might all be the product of one glass-working centre, since it is abnormal to lack the ground finish around the rim of pillar-moulded bowls (Price 1995: 146).

[37] There is no reason given for the omission of material for the publication.

these contexts may be residual, there are 11 examples that appear to be in post-Flavian contexts, in which they may have been residual material that was still in use. Price suggests that pillar-moulded bowls were likely out of production but still in use in post-first century contexts, so they may still have been made during the occupation of the fortress (Price 1995: 147).

3.2.1.2 Small Bowl or Cup

Item bag 82.10H/8 contains the only example of a cup, or possibly a small bowl that has been cast. It is a dark blue convex wall fragment (Price 1995: 143, 145, No. 4) that was found in a well-dated pre-Flavian (68 FM (1)), accompanied by a copy of a Claudian *as*, a fine Italian colour-coated pottery cup, and seventeen samples of Samian ware of types 15/17, 18, 24/25, 27, and 29 (Manning 1981: 186). The fragment has nothing distinguishing about it other than the fact that it is dark blue, which is less common for cast vessels in Britain than dark green (Price 1995: 145).

3.2.1.3 Plate or Shallow Bowl (Appendix 1.A.5)

The only example of Isings Form 5[38] at Usk is a dark green base fragment (number 82.10H/7). This was found in the fortress closure pit 'DUU' (Price 1995: 145, No. 3, Fig. 42). The vessel has a base diameter of 11 centimetres and stands on a solid vertical base ring, but whilst it appears that it could be Isings Form 5, not enough remains of the vessel's walls to see if there is a convex shape (Price 1995: 143). As it was discarded in a closure pit, its context does not help to determine its status, but if it is a plate, rather than a bowl there might be an argument for it having high status. This is only a speculative argument, based on the fact that glass plates are relatively rare forms in the first century A.D. and many of the functional or appealing attributes of glass are

[38] Notable examples of this form come from Colchester (Harden 1947: 143).

nullified by using it as a plate. There is less concern about a transfer of taste and odour to solid food items sat upon them, than there would be for liquids inside containers, or cups, which are actually raised to the mouth. It is also already possible to see items on a plate regardless of whether the vessel is transparent or not, where transparency is functional for observing the quality of the contents of a cup, bottle, or jug. If there is no concern about taste or transparency, then there is no necessity to choose glass over more durable metal ware or ceramics, unless there is a desire to show off the colour and lustre of glass.

3.2.1.3 Core Formed Vessel

There is one possible example of a core-formed vessel, but it is more likely a very severely worn example of a vessel cast through other methods, or even (though less likely) a blown vessel. Item bag 82.11H/470 contains five small, unpublished, dark blue fragments of an indeterminate vessel form found in feature 73 HBP (1) 1, which is not recorded in Manning's publication. There is some evidence for rib decoration, but nothing else can be determined. This vessel is tentatively identified as core-formed because the fragments have a pronounced curvature, suggesting a small, closed-form vessel that could not be lifted away from the interior former. In addition, the tiny fragments were fairly thick and dense. The five fragments weighed seven grams, despite their small size, and blown glass is often thinner and lighter. If these fragments do represent a core-formed vessel, it would be a remarkable find for a site so far west in the Empire and at a mid- to late-first century date. Core-forming is the oldest known form of glass vessel production, and since more advanced, more efficient techniques were developed one might reasonably expect core-forming to have died out. As this is the only potential example present in this assemblage, it is unlikely that it was produced locally, and may well have been an item passed down as an heirloom that had travelled great distances to reach Usk.

3.2.2 Blown Glass

The quantity of blown glass at Usk was staggering, making up nearly 88 per cent of all the glass from the Roman period (Fig. 3.7), and virtually all of the post-Roman glass. The Usk fortress provides examples of both major types of blown glass: mould-blown, and free-blown.

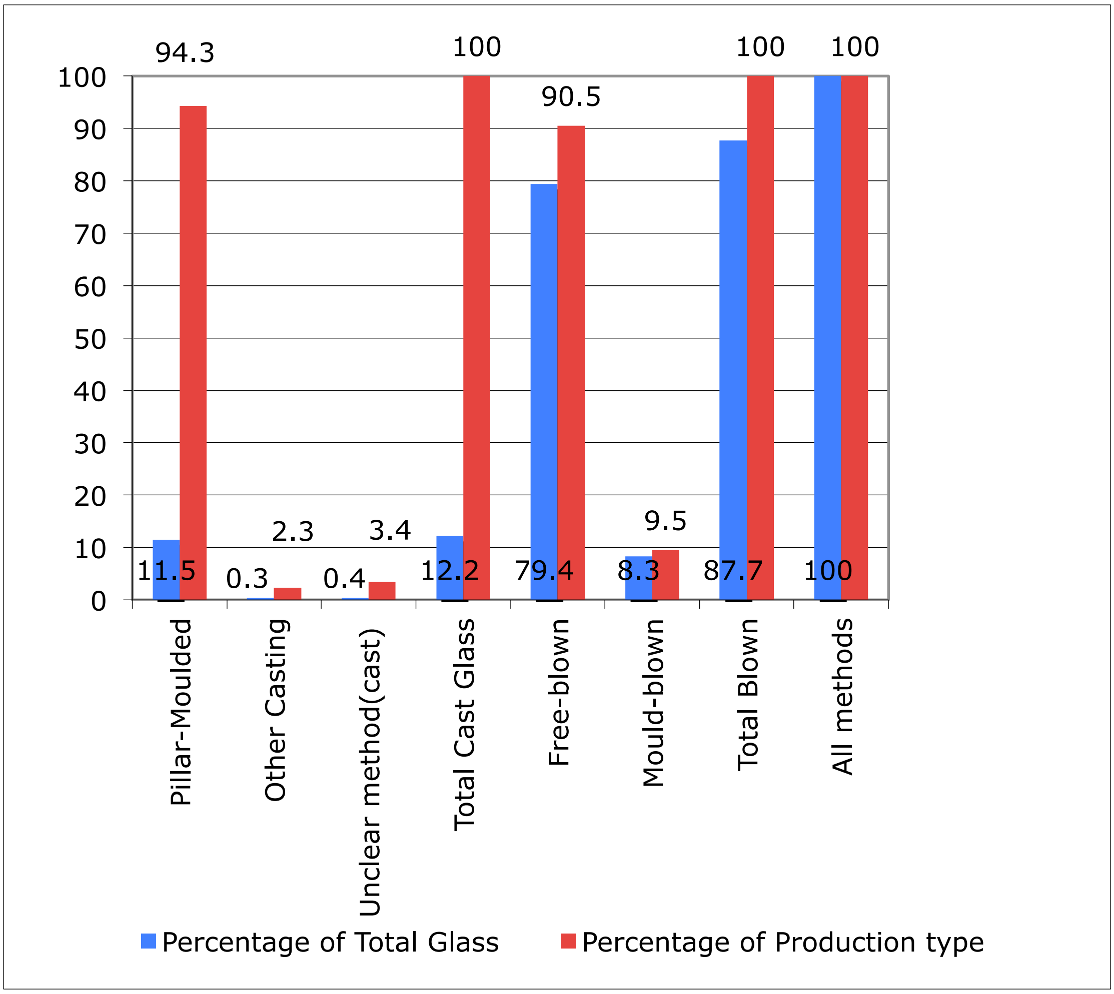

Figure 3.7: Representations of production techniques relative to the total Usk glass assemblage and the broad production type.

3.2.2.1 Mould-Blown Vessels

Mould-blowing is always interesting in an assemblage, because it can produce both the most simple, mass-produced, utilitarian vessels, and also the most intricate, decorative, and most widely discussed vessels. Some tell us about the type of mould; exhibiting mould seams and surface inclusions. Some have intricate mouldings, and others simply have a texture that is smooth like free-blown glass on the interior, but has a slightly rippling texture to the exterior produced by contact with the mould. There is relatively little mould-blown glass at Usk. It only makes up 9.5 per cent of the blown glass and 8.3 per cent of the Roman glass assemblage (Fig. 3.7), but there is, nonetheless, much to discuss. The plain utilitarian items produced through mould-blowing are generally storage containers, like cylindrical or prismatic bottles. If we exclude them for the moment, then we are left with only a handful of vessels. The glass report for the Usk excavations records only eleven fragments of mould-blown glass, representing at least six, and a maximum of eight vessels. When the unpublished fragments are included, the assemblage contains between nine and eleven mould-blown vessels with recognizable forms or general vessel types, and eight unidentifiable fragments, some of which could come from small bottles or in one case, a jug.

Table 3.4: Mould-blown forms at Usk

Vessel Type	Description	MNI	Date Range
Ovoid cups	Layered glass with an opaque white interior and yellow-brown exterior with triangular bosses	1	First century A.D.
Mould-blown beaker (Appendix 1.B.31)	Conical beaker with bosses	1	Mid-first to second century A.D.
Gladiator cup: related to Isings Form 41b (Appendix 1.B; Fig. 3.7)	Hemispherical cup with the image of a gladiator in combat	1	First century A.D.
Tall ovoid cup (Appendix 1.B, Isings 17 and Price and Cottam Fig. 15; Fig. 3.8)	Blue-green with seven vertical ribs preserved	1	Third quarter of the first century A.D.
Cup or unguent bottle	Small dark green fragment with a circle and ring and central pellet in low relief	1	N/A
Cups of indeterminate form		3	N/A
Hemispherical ribbed bowl (Appendix 1.B: Isings 17?; Price and Cottam Fig. 14; Fig. 3.9)	Moulded vertical ribs	2	First century A.D. *circa* A.D. 43- *circa* A.D. 75-80. (Price and Cottam 1998: 61)
Shallow bowl or plate	Blue fragment with gradual curve	1	N/A
Small jug or bottle	One base and body fragments of several colours	5	N/A

3.2.2.1.1 Cups and Beakers

Of the fragments of mould-blown glass found at Usk only one was polychrome. This fragment has a translucent yellow-brown exterior with parts of two triangular bosses in raised relief, and an opaque white interior fused together to form what Price refers to as ‘cased glass’ (Price 1993: 70). Cased glass is incredibly rare for decorative mould-blown vessels. Most mould-blown vessels were monochrome, and Price only knew of one other example of cased mould-blown glass from anywhere in the Roman world, which came from Verulamium, modern day St. Albans, Hertfordshire.[39] This possibly indicates that these vessels were custom-made decorative pieces. The form cannot be recognised from the 1.6 x 2.2 centimetre fragment, but it may be an ovoid cup, as cups with triangular bosses are known from several sites on the continent including Xanten (Charlesworth 1984: 288, No. 5.9; Price 1995: 150, 153, Fig. 43). It is possible that this fragment postdates the period of this study; as it was discovered in a third-century gully, but its strong colour, and the presence of layered glass with similar forms in other first-century sites suggest that it is probably residual material. It is also represented by just a single fragment, which like many examples from the fortress period could hint at the rest of the vessel having been collected for recycling. If the vessel did belong to the third century, the chances of more fragments surviving would be greater since the fortress was gone and no glass industry would have been immediately present to recycle it.

The embossed conical beaker (Isings Form 31) is a form that Isings argues was fairly costly. She claims that they were used to imitate luxurious items such as embossed silver vessels, without imparting the taste of silver on their contents (Isings 1957: 45-46). The Usk assemblage contains just a single pale green fragment of this form, with parts of two almond shaped bosses separated by a small round pellet. This form appeared around the late 60s A.D. and appears fairly frequently in early Flavian contexts[40] (Price 1995: 150), however it is found in small numbers, leading Isings to suggest that it was a fairly prestigious and costly form.

Items 82.10H/81 and 82.10H/82 (Price 1995: 153, Nos. 24A and 24B, Fig. 43) represent either one or two dark green mould-blown cups. They come from separate

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[39] The Verulamium example is unpublished and was only known through Price's personal contacts (Price 1993: 70).

[40] Isings dates this form from a number of examples from Pompeii, Vindonissa, and Nijmegen (Isings 1957: 45-46).

contexts over 150 metres apart, but are identical in colour.[41] These are particularly interesting fragments because they are from the famous ‘gladiator cup’ or ‘sport cup’ style, which is found across Italy and the western Empire. This form has a simple cylindrical body shape and flat or concave base, but is decorated with scenes of gladiators or chariot races. Number 24A has a visible mould seam and part of a raised relief letter that appears to be a ‘P.’ Number 24B has a raised relief of part of a gladiator’s torso, upper left arm, upper left leg, and an object to the right of the torso, below the out-stretched arm that may be the edge of a shield (Price 1995: 153). This scene is quite similar to the green gladiator cup in the Xanten Vetera I Assemblage (Rheinisches Ländesmuseum, Bonn: inventory number 25238), which shows a gladiator in much the same pose with a dropped rectangular shield between him and his opponent (cf. Xanten Gladiator Cup section 5.2.2.1.1). The preserved writing on the Xanten cup reads “[---]S PROCVLV[---],” which could tie these cups together. Price suggests that the “P” on the Usk gladiator cup is the initial letter of PETRAITES, the name of a famous gladiator who is known from a complete cup from Chavagnes-en-Paillers, France (Price 1995: 151). The completed cup reads “SPICVLVS COLVMBVS CALAMVS HOLES” and “PETRAIES PRVDVS PROCVLVS COCVMBVX” with the mould seam separating the two sections of text (Harden *et al* 1987: no 90). The “P” on the Usk vessel following the mould seam could indicate that this cup is of the same design, if not from the same mould, and the “S PROCVLV” on the Xanten cup could come from “PRVDVS PROCVLVS.”[42] It is not known exactly where this cup was made, but its similarity to others in the western Empire shows that there was a sharing

[41] 24A comes from a gully that was not datable (HPA (1)), and 24B comes from feature 68 BA (3) (Price 1995: 153), which was the metalling of East-West road SII, which has pre-Flavian origins (Manning 1982, 121).

[42] If 24B is from the same cup as 24A then the gladiator pictured could be Spiculus, Calamus, or Petraites, who all carry shields on their left arm (Harden 1947: Nos. 50-5: Cool and Price 1995: 49 No. 237).

of design ideas and/or widespread trade of cups or moulds from some workshops. The prevalence of the designs and the repetition of certain gladiators' names show that the same ideas and designs were moving around, and that moulds were being reused to produce numerous identical vessels for trade.[43] Due to its close resemblance to continental examples, it is likely that this cup was imported as a showpiece to indicate the sophistication of the owner and to keep up with fashionable trends, but this does not mean that this fashion was restricted to the top classes of society, since the form is widespread.

The first of two mould-blown bowls in the Usk collection is a ribbed example resembling Isings Form 17 (Isings 1957: 35-36; Price 1995: 155, No. 26, Fig. 43). It lacks the marvered threads in Isings' form description and the ribs are blown rather than trailed, but Form 17 is the closest match in Isings' typology. It may, however, be a distinct class of mould-blown hemispherical or ovoid cups or bowls, which are slightly taller than Isings' Form 17 and are related to sport cups. The mould-blown hemispherical cup or bowl forms, dating from *circa* A.D. 43- *circa* A.D. 75/80 in Britain, are relatively simple and are known from many different sites[44] suggesting that they were not overly rare or luxurious (Price and Cottam 1998: 60-61). Decorations such as chariots, gladiators, and triangular bosses, like those on the Colchester cup, were more popular than the plain, ribbed variety, indicating that even highly decorative mould blown wares were not difficult to reproduce and may not be restricted to very high status individuals (Price and Cottam 1998: 61-63).

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[43] Fragments of similar cups are also known from France, Italy, and Spain (Price 1995: 151), as well as from at least six other sites in Britain including more than one example from Colchester (Harden 1947: Nos. 50-5: Cool and Price 1995: 49 No. 237).
[44] A ribbed example of this form was found nearby at Caerleon, and other examples have been found at Binchester, Fishbourne Palace, West Sussex, London, Sea Mills, and Topsham Devon (Price and Cottam 1998: 61-63).

Figure 3.8: Tall ovoid cups. (After Price and Cottam 1998: 62, Fig. 15)

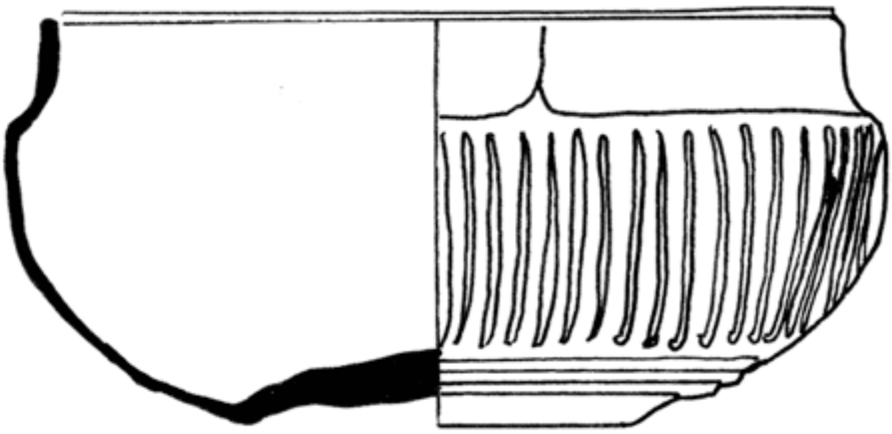

Figure 3.9: Hemispherical ribbed bowl (After Price and Cottam 1998: 62, Fig. 14)

A shallow, light-green bowl (Fig. 3.9), found (Price 1995: 153, No. 25, Fig. 43) in a rubbish heap created during the abandonment phase, but full of late-Neronian material, appears to have been discarded after use rather than collected for recycling. This indicates that there was no continued intensive occupation that would have supported a glass industry. The bowl has a vertical rim, and is decorated with pale yellow streaks and 100 closely set ribs running from the shoulder to a pair of horizontal ridges on the lower body. The base has three raised concentric rings and a central pellet, and there is a vertical mould seam on either side of the vessel, which shows that it was made in a two-part body mould with a separate base piece. This vessel resembles Isings Form 17 (Isings 1957: 35-36) but lacks the marvered threads, and the ribs are blown rather than trailed. This form is common in Claudian to early-Flavian sites in southern

Britain, but is quite rare in northern Britain, so may be a form that was produced locally rather than being a regularly traded item in the Roman world (Price and Cottam 1998: 60-61).

The last mould-blown vessel of note is identified from three joining colourless, cup or beaker fragments, that form a vessel with a minimum body diameter of 6.8 centimetres (Price 1995: 155) found in the late Neronian fortress pit 'HPR (6)' (Manning 1989: 56). These fragments bear a vertical mould seam, and have a leafy tendril design in raised relief. Most notable are both the leafy tendril design, which is often associated with eastern mould-blown wares, and the fact that it is colourless. There are no other examples of this design known from Britain (Price 1995: 153),[45] which, along with the design and lack of colour, suggests that it was a high status imported item. Colourless glass was rare in the first century due to the difficulty of making good quality, transparent, colourless glass. Additives had to be included to prevent the oxidation of impurities, which colours natural glass. Pricing evidence from the fourth century, lists colourless glass as twice the price of naturally coloured glass (Diocletian *Price Edict* 16.1-9).

The remaining mould-blown entries contain a few contentious examples and non-discernable forms. They are strongly coloured pieces, typical of the early and mid-first century. One has a preserved moulded concentric circle and pellet (Price 1995: 155, Fig. 43), and the other two are identified strictly based on texture.

3.2.2.1.2 Bowls or plates

Only one mould-blown fragment fits into the plate or shallow bowl category, and it is again categorised by texture and is quite unremarkable. Number 9955H/10 is a

[45] The nearest vessel with this design comes from the second-century *canabae legionis* at Nijmegen (Isings 1980: 293).

blue fragment found by the eastern fortress defences. It had a very gradual slope that was not accentuated enough to fit a deep bowl or cup.

3.2.2.1.3 Containers

There were eight further pieces that had textures suggesting that they were mould-blown. One is a flat blue-green base fragment that may belong to a jug or small bottle (82.11H/300), but the rest are unremarkable body fragments. Most are the standard blue-green, however, there are fragments from a light blue, and a dark blue vessel.

3.2.2.1.4 Summary of Mould-blown Wares

If the unidentifiable fragments all represent individual vessels, and if the maximum number of vessels from the other fragments is assumed, then there could be a total of 18 mould-blown vessels, excluding the bottles that will be discussed later. Even this maximum would mean mould-blown tableware represents only 2.5 per cent of the estimated MNI of 720 vessels at Usk. Of these, there is a possible six or seven cups or beakers (one of which may be an unguentarium), one or two bowls, one shallow bowl or plate, one jug, and seven undetermined vessels. The small numbers may indicate a relative level of prestige, but there is not enough contextual information to claim confidently that they all belonged to the wealthiest people in the fortress. After all, many of the designs are fairly simple, and the appeal of mould-blowing, as a decorative technique, is that large numbers of identical vessels can be quickly reproduced without the added costs of producing new formers every time.

3.2.2.2 Free-Blown Vessels

Table 3.5: Free-blown vessels at Usk.

Vessel Type	Isings Vessel Form	Description	MNI	Date Range
Beakers and cups	I 21 or I 34	Facet-cut beaker	2	First - second century A.D.
	I 34	Beaker with wheel-cut decoration on a base	2	First - fourth century A.D.
	I 30, I 34, or I 36	Beakers with abraded bands	4	First century B.C. - first century A.D.
	I 32	Indented beakers	4	First - Fifth Century A.D.
	I 33	Beakers with applied decoration	2	Claudian/Neronian - first half of second century A.D.
	Uncertain	Indented base	1	N/A
	I 12	Hemispherical cup with wheel-cutting	47	First century B.C. - first century A.D.
	Uncertain	N/A	75	N/A
Bowls	I 42 or I 44	Bowl on a base ring	8	First century B.C. - first century A.D.
	I 44 or I 45	Deep bowl with tubular rim or shallow bowl	5	First century B.C. - first century A.D.
	I 17	Bowl with pinched or applied ribs and marvered white trails	1	Mid first century A.D. to early Flavian (60-early 70s A.D.)
	I 69	Bowl with cut-out or folded sides	1	Mid-late first century A.D. - early second century
	I 75	Trulla/saucepan	1	First Century A.D. -Third Century A.D.
	Uncertain	N/A	5	N/A
Plates	I 46b, I 46c, or I 47	Plate or shallow dish with or without a base ring	2	First century A.D.- fourth century A.D.
Jugs	I 55	Jugs with conical bodies	37	Second half of first century A.D. - third century A.D.
	I 56	Jugs with trefoil mouths or spouts	13	First century A.D.-cecond century A.D.
	I 52	Bulbous or ovoid jugs	1	Claudian/Neronian - mid-second century A.D.
	Uncertain	N/A	37	N/A
Flasks	I 16	Teardrop flask	8	First century A.D.
	Uncertain	N/A	1	N/A
Flasks or unguentaria	I 61	Aryballoi	1	First century A.D. - fourth century A.D.
	Uncertain	N/A	18	N/A
Unguentaria	I 8 and I 27	Tubular unguentaria	44-45	First century B.C. - fourth century A.D.
	I 28 a and 28 b	Unguentaria with wide bodies and flattened bases	11	Claudian/Neronian - end of the first century A.D.
	I 26	Small Pyriform unguentaria	2	Mid-first century A.D. to second century
	Uncertain	N/A	6	N/A
Amphorisk	I 15	Amphorisk on base ring	1	Augustan-Tiberian - second century A.D.
Jars	I 67	Bulbous or ovoid jar	24	Claudian/Neronian - second century A.D.
	I 63, I 63, I 64, or I 65	Jars with funnel mouths	10	Mid-first century A.D. - second century A.D.
Bottles	I 50 and I 51	Prismatic and cylindrical one-handled bottles	84	Claudian - third century A.D.
Unidentified	N/A	N/A	132	N/A

The vast majority of the Usk glass was free-blown, as one might expect from a mid-first century site. The free-blowing technique produced almost every form represented in the collection. There is far too much material, summarised in table 3.5, to provide a detailed discussion of every fragment or identified vessel, but information is recorded in Appendix 3. Price (1995) has also catalogued a substantial portion of the free-blown glass, and gives description of all the forms present. What is important here is to calculate the total numbers of vessels, including the unpublished material to evaluate how the total body of free blown glass compares to other production types from the Usk fortress site.

3.2.2.2.1 Beakers and Cups (Appendix 1.C.1-2)

There are an estimated 137 free-blown items that represent the remains of beakers or cups. Evidence points to 16 likely beakers (greater in height than diameter) among this number. Up to half of these beakers appear to have been intentionally decolourised. Natural blue-green and colourless glasses are represented by seven vessels apiece. Of the remaining two, one has such a slight light green tinge that it is likely that it was intended to be colourless, and the other is naturally coloured, but with a yellow-green rather than blue-green tinge. These vessels cover a possible range of forms including Isings' 21, 30, 32, 33, 34, 35, and 36b (Price 1995: 158-166; Isings 1957: 37-38, 44-52). The fact that so many are colourless, and that most have some form of decoration again indicates the possibility of them being high status vessels. This might suggest that officers owned many of the beakers, since they would have had greater wealth than the common soldiers and could afford colourless glass, which as noted above (section 3.2.2.1.1) may have been up to twice the price of natural glass items of equivalent size and form. The association of colourless glass with beakers may then support Cool's argument that cups and beakers were primarily used by officers, who tended to prefer small individual drinking vessels to communal bowls (Cool 2006: 178).

Two colourless vessel fragments appear to be representations of either Isings Form 21 or Form 34, which are facet-cut beakers with horizontal abraded lines and defined bases (Appendix 1.C.1.21, 34).[46] Facet-cut colourless beakers are fairly common in Flavian Britain, but at least one – and likely both, given the dates of the fortress occupation – is remarkable for dating before the form became popular. Price's number 36, comes from a well-dated, Neronian fortress pit.[47] A further two decolourised vessels are represented among the two or three examples of Isings Form 34 beakers with wheel cut decoration and a base. This form includes the light green/almost colourless vessel, which is nearly complete (Price 1995: 162, No. 46 Fig. 43, Plate XIII).

Four objects (Price 1995: 163-164, Nos. 49-49c) come from indented beakers that could match Isings Form 32 (Appendix 1.C.1.32), the indented beaker, or Form 35, the indented beaker on a foot (Isings 1957: 46-7, 49-50). The preserved ovals on the green-yellow fragment 49 and blue-green 49a are quite large, but colourless fragment 49c has a long narrow indent. Fragment 49b is also colourless with a slight greenish tinge, and has the edge of an indent, but its size cannot be determined.

There are two possible examples of colourless Isings Form 33 beakers, which have applied decoration and evidence of linear cutting and tooling (Appendix 1.C.1.33). Price's (1995: 163) number 48 has a single horizontal wheel-cut line above arcading, which could be the tops of applied ovals that imitate the indents on Isings Form 32. Number 48a has applied vertical ribs as its decoration, rather than ovals. These styles

[46] Facet-cut fragments could also fit Isings' Form 21 beaker/goblet (Isings 1957: 37-8), but there is no evidence for a base.
[47] The pit is dated by fortress-period coarse wares, a fine Italian colour coated cup, Samian wares of styles 15/17, 18, 24/25, 27, and 29, as well as a copy of a Claudian *as* coin (Price 1995: 158-159; Manning 1981: 186).

have been found at a few sites in Britain including Caerleon (Nash-Williams 1929: 257), Caernarvon (Allen 1993: 222), South Shields, and Colchester (Cool and Price 1995: 71), but it is quite a rare form, mostly known from northern Italian and southern Swiss sites, such as Vindonissa (Berger 1960: 47-8), indicating that these are probably imported items (Isings 1957: 47).

The remainder of the beaker fragments are relatively unremarkable and mostly include naturally coloured glass. Naturally coloured vessels could indicate that it was not only the highest-ranking officers or legionary legates who used beakers in the first century, but owing to the systematic demolition of the fortress the contextual information cannot confirm the exact use locations of these vessels.

The most common blown tableware at Usk is another drinking vessel known as a Hofheim cup (Table 3.6), after the site at which large quantities of this form were discovered (Ritterling 1912: 365-6, Forms 1-2). This style of cup matches Isings Form 12 (deep bowl and hemispherical cup Appendix 1.C.2.12) (Isings 1957: 27-30). Isings Form 12 vessels were widely used throughout the first-century A.D. Roman world, and are identified by their squat shape with simple cracked-off and polished rim, and by their horizontal wheel-cut or abraded lines (Isings 1957: 28; Price 1995: 159;). Price (1995: 159) noted a possible 44 examples of this form in her publication, but with the addition of unpublished material this number rises to a possible 47 vessels. These come in a range of colours. Six are made of a nearly colourless and potentially relatively costly glass, but the most prominent colour is the natural blue-green, followed by dark blue and a yellowish-brown that were common in the first century, indicating that this form was primarily a common, utilitarian form.

Table 3.6: Colours of Hofheim cups at Usk (Price 1995: 161-162 Nos. 37-45u).

Colour	Yellow-brown	Dark brown	Dark green	Pale green-colourless	Greenish-yellow	Dark blue	Pale blue	Blue-green
MNI	8	1	1	6	5	9	1	16

There are 75 other items that are identifiable as probable cups, beakers, or small bowls used for drinking (Table 3.7), but cannot be defined more precisely. Most of these are unpublished, and with the exception of three rims (82.11H/210, 82.11H/106, and 82.11H/107) they are all body fragments. Most are undecorated, aside from 82.10H/460, which has a spiral rib, and one of the fragments in 82.11H/233, which has a hint of an abraded line and may be an additional Isings Form 12 vessel. There are also two layered fragments, which are items 32 and 33 in the Usk publication (Price 1995: 158, Fig 43).

Table 3.7: Unidentifiable free-blown cup colour distribution.

Dark blue	Blue-green	Yellow-green	Yellow-brown/amber	Light blue	Pale green	Colourless	Layered blue/white
21	29	4	1	9	2	7	2

3.2.2.2.2 Bowls (Appendix 1.C.3)

In addition to the estimated minimum number of 137 free-blown drinking vessels or small bowls recorded so far, there are at least 21 other vessels that can be identified solidly as forms of bowl (Table 3.5). The most prominent of these bowl forms is similar to the cast bowl Isings Form 20 (Isings 1957: 37; Appendix 1.A.20), the bowl on a foot/applied base ring, but in a blown variety (Isings 1957: 58). There are eight such vessels in the Usk assemblage, and they can be assigned to either Isings Form 42, or 44 (Table 3.8; Appendix 1.C.3.42, 44), but no rims are present to guarantee Form 44. Both of these forms can have the solid applied base ring as is displayed by these fragments (Fig 3.10) but are equally, if not more commonly found with tubular base rings.

Table 3.8: Isings Form 42 or 44 colour distribution.

Colour	Brown	Dark blue	Blue-green
Number of Vessels	1	3	4
Reference	Price 1995: 167, No. 60, Fig. 44	Price 1995: 167, Nos. 58, 59, and 59a, Fig. 44	Price 1995: 167, 169, Nos. 61, 62, 63, and 63a, Fig. 44

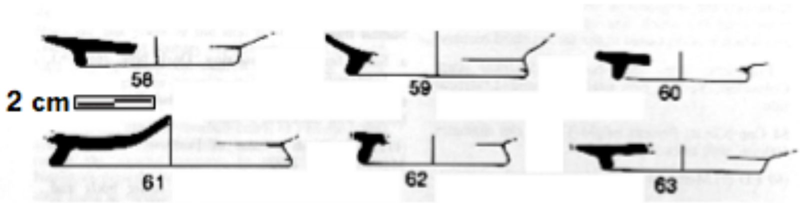

Figure 3.10: Solid base rings from Usk (After Price 1995 Fig. 44).

Some of the bowls fragments from Usk could fall into either the category of Isings Form 44, a deep bowl with a tubular rim, or a shallow bowl with slightly more vertical sides than Form 44, recorded as Form 45 (Isings 1957: 59-60; Price 1995: 169, Nos. 64-67, Fig. 44). Form 45 is the second most highly represented free-blown bowl form. Price's numbers 69 and 70 (Price 1995: 169, Fig. 44) are blue-green examples that are recorded as fitting either Isings Form 44 or Isings Form 45. Only their closed ring bases are preserved, meaning that they could come from any bowl in the range of Isings Form 41 to 45, 69, 75, or even some non-bowl forms such as Isings Forms 34, 35, 37, or 52[48] (Isings 1957: 48-9, 52, 56-61, 69, 92).

There is only one example of a bowl with fine, vertical, trailed ribs (Isings 1957: 35-36, Form 17; Appendix 1.C.3.17). This is a natural blue green fragment (99.52H/26), which lacks the marvered white lines that are frequently found on these bowls. Structurally, however, the vessel matches the form, and if the mould-blown examples in section 3.2.2.1.1-2 are any indication the marvered threads may not have been fashionable at Usk.

A Roman post-hole yielded one blue-green bowl with a cut out ridge or fold on the body below the rim (Isings 1957: 89-90, Form 69; Price 1995: 169, No. 68, Fig. 44; Appendix 1.C.3.69). Price says that the form (Fig. 3.11), is not recognizable from the fragment, although the profile which folds out and back in creating a tubular ridge

[48] Although their contexts suggest first century origins, Price acknowledges the possibility of them matching some second-century forms too: Isings 85, 88, 90, and 104 (Price 1995: 169; Isings 1957: 101, 104, 118, and 122-3).

around the centre of the vessel nicely matches the 69b form in Isings, known from a cemetery dating from *circa* A.D. 70-105, in Nijmegen (Isings 1957: 89). Another two bowl fragments have prominent horizontal ridges below their rims (82.10H/63 and 82.11H/116), which might be imitating this form, although both rims are cracked off and fire rounded rather than folded out as Form 69 typically is.

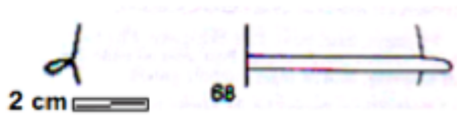

Figure 3.11: Bowl with a folded wall (After Price 1995: Fig. 44).

Two dark green fragments likely represent a type of bowl with a single saucepan handle, referred to as a *trulla* by Isings (1957: 92, form. 75; Appendix 1.C.12). Price notes that owing to their identical dark green colour, these fragments possibly could be from the same vessel (Price 1995: 165, 167, Fig. 44, Nos. 55 and 56). This connection is far from certain, since they are individual fragments found over 100 metres apart, and since dark green is a relatively common colour in first-century Britain, but for MNI count purposes they must be considered as one since it is not impossible for fragments to become separated during deposition or later disturbance[49] (Price 1995: 165, 167). Fragment 55 is almost certainly of a *trulla* as its single horizontal ribbon handle is preserved, but number 56 is just a rim and part of a cylindrical body meaning it could be a bowl without a handle. While *trullae* have the appearance of saucepans, they would not have been used in the same way due to the potential for discolouration and warping from fire. The trulla may be a form of bathing dipper, since the existence of metal dippers is widely attested in Roman contexts, but there is not enough contextual information to identify a definite use.

[49] Widespread deposition could be caused by numerous different factors including the loss of one fragment near the breakage site while most of the vessel was collected and moved to a discard location, or the disturbance of fragments during the demolition of the fortress or later construction processes.

3.2.2.2.3 Plates (Appendix 1.C.4)

Figure 3.12: Plate or shallow dish forms (Sketched by author after Isings 1957: 62).

The Usk assemblage contains only two recognizable free-blown plates or dishes (fig. 3.12). Price's number 57 (1995: 167, Fig. 44) is a rim, which matches Isings Form 46b, 46c, or 47 Isings 1957: 61-2; Appendix 1.C.4). The second plate is a nearly completely restorable unpublished piece. It is circular, with a horizontal, outward-folded, tubular rim. It was found after the main period of excavation and is recorded as 'Red 4' rather than in the ordinary recording system of the site. As was noted in the cast plate section, glass plates are generally uncommon, possibly indicating that they held a place of relative prestige. Item 'Red 4' is also high-quality, intentionally decolourised glass providing a stronger argument for this piece being higher status glass than even the cast examples. Its context cannot help much with determining the status of this plate. It comes from the 1976B excavations, which extended from the rear wall of the fortress baths into the generically labelled 'Ancillary buildings' (Fig. 3.6).

3.2.2.2.4 Jugs (Appendix 1.C.5)

Fragments of serving jugs were common in the Usk excavations. Between the published and unpublished material there are 200 fragments that are identifiable as jugs. Most of these examples appear to come from jugs with conical bodies (Isings 1957: 72-74, Form 55) or, to a lesser extent, those with trefoil mouths or spouts (Isings 1957: 74-76, Form 56). These fragments added up to approximately 88 vessels. There were a further 11 vessels, represented by 38 fragments, that could only have their forms narrowed down enough to say that they were jugs or flasks, and ten fragments of seven vessels that could be either jugs or bottles.

Most of the jugs bear some sort of decoration, even if it is just the design of the handle. This would suggest that they were intended to look nice while being used to serve liquids, but there is nothing about the decoration that would imply that they are strictly luxurious. In fact, their large numbers and natural colours would suggest that they were widely available within the fortress.

The easiest jug form to identify is Isings Form 55 (Appendix 1.C.5.55). Unlike many forms, body fragments alone can frequently identify it. If enough of the vessel survives to recognise the slope and curvature of the walls, or if the angle changes through the shoulder and into the neck or toward base are visible, but they are most readily identified by fragments of the neck and/or handle, which tend to survive quite well. The neck is often fairly tall and narrow with the handle attaching on one side at or just below the rim. As a result of the tall neck the handle is usually longer than handles on bottles, and the handle attaches at the shoulder and body where the conical shape starts to appear. If the lower handle attachment is present the form can be easily identified because it forms to the shape of the body and often trails down the side of the vessel. The handles themselves often have one or two prominent vertical ridges, and finish with the ridges extending into a trail, or a trail with pinched, horizontal ridges. At Usk, there are approximately 37 vessels identifiable as Isings Form 55, the majority of which are natural blue-green. There are also yellow-green and yellow-amber examples.

The next most common jug form at Usk is Isings Form 56 (Isings 1957: 74; Appendix 1.C.5.56), which appears to imitate a bronze oinochoe type. This form is more common in the second century A.D. than the first (Price 1995: 179), but there are 13 examples from the fortress at Usk, and pre-Flavian examples from Pompeii, which confirm that it was extant at the time relevant to this study (Isings 1957: 74-75). The numbers from Usk suggest that the form was not particularly rare in the mid-first century. Its trefoil or spout shaped rim might have made it pour better than Form 55, and may have taken slightly more work to finish, but there is no reason to believe that it was out of the price range of most citizens.

The only other identified jug form was the bulbous or ovoid jug (Isings 1957: 69-71, Form 52; Appendix 1.C.5.52). Of this form, there is only one blue-green vessel represented by 18 fragments from a fortress latrine (Item bag 355; Price 1995: 182, No. 114, Fig. 47). The original rim is missing and the neck has been ground down to form a new rim suggesting that, while it is naturally coloured, it was valued enough to rework after being damaged. The value may stem from its form and incredibly fine walls (0.09 centimetres thick), which are rare in Britain. The only other comparable example was found at Colchester (Thorpe 1935: 25). This type of jug would, however, have been an unsurprising find had this been a western Mediterranean site dating from the Claudian-Neronian period onward, so British examples are likely to have been imported (Price 1995: 178-179; Isings 1957: 69-70).

The jug category is rounded out by fragments of 37 jugs with no specific form (Table 3.9). They are all blue-green in colour, except for one, which is yellow-green. There is slightly more variety in the vessels that may be either jugs or flasks. They include blue-green, brown, and dark blue. The uncertainty comes from their body shapes combined with the lack of any handles. A few of these also bear decoration. Six bear have opaque white marvered blob decoration and one has vertical ribs, which may identify it as either a jug of Isings Form 52b, or Isings Form 71 (Fig. 3.13); a flask with trailed on ribs (Isings 1957: 90)

Table 3.9: Probable jugs of no specified form.

Dark blue	Brown	Yellow-green	Yellow-brown/amber	Colourless	Light green	Light blue	Blue-green
2	1	1	2	1	4	5	21

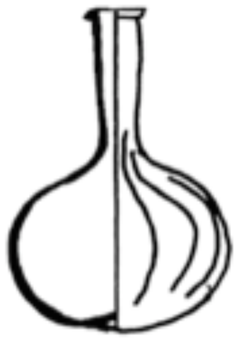

Figure 3.13: Isings Form 71 flask with vertical trailed ribs (Sketched by author after Isings 1957: 90).

3.2.2.2.5 Flasks (Appendix 1.C.6)

Clearly identifying flasks in fragmentary form can be a challenge. Depending on its size, a flask rim on its own could be confused with that of a bottle, jug, or some types of unguentarium. A partial neck on its own has this same problem, and a base or general body fragment is often identical to those of a jug or unguentarium. If a neck or body is not complete it is often impossible to be certain if there was a missing jug handle. As a result only 10 or 11 examples can be confidently called flasks.

Of positively identified flasks, one of an uncertain form is represented by two joining blue-green fragments, and the remaining eight are likely the typical first-century, tear-drop shaped flask (Isings 1957: 34-5, Form 16; Appendix 1.C.6.16). Most are blue-green, although one is colourless, and one is pale green.

3.2.2.2.6 Flasks or Unguentaria

There are 18 vessels from Usk that could be either flasks or unguentaria. All of the examples, except for one light blue fragment, are natural blue-green, and most are represented by rims and necks. Only two base fragments survive, and five of the vessels include body fragments. These could all be small teardrop flasks, or larger unguentaria like Isings Form 28 (Fig. 28) (Isings 1957: 41-43). There is virtually nothing separating these forms shape-wise so one is entirely reliant on having enough of the vessel, or large enough fragments, to make a judgement about the size of the complete vessel. Then one can decide whether it should be described as a larger flask, or as a smaller unguentarium form. This distinction is unlikely to be important in items that are too close to distinguish, however, because many both may have been functionally similar. Both forms likely contained oils and other toilet goods, although flasks may also have contained food condiments.

The aryballos was an identifiable form that could be considered either an unguentarium or a flask (Inventory 82.10H/227; Isings 1957: Form 16; Price 1995: 172, No. 81, Fig 45; Appendix 1.C.7). It was commonly used for bathing practices (Allison 2013: 101), and is occasionally still found with a bronze chain and stopper still attached (cf. Herculaneum Aryballos Section 6.2.2.3.6). This form was common from the first century A.D. through the fourth century, and Isings states that it had become almost ubiquitous at Roman sites by the Flavian period, so it should not be surprising on a site dating just prior to the Flavian emperors and should not be considered a high-status form (Isings 1957: 79).

3.2.2.2.7 Unguentaria (Appendix 1.C.8)

Unguentaria are generally plain utilitarian items that would have been used by most people in Roman society. They were used to contain the oils and perfumes needed for bathing, or for cosmetics or medicine. The most common form of unguentarium at Usk is easy to identify by its small tubular body, which generally has some constriction around the middle, separating the neck from the body (Isings 1957: 24, Form 8; Appendix 1.C.8.8). The body is usually not much bigger in diameter than the neck, and in some cases there is almost no differentiation at all. Isings notes those with virtually no difference, or with no constriction, as a separate form (Appendix 1.C.8.27), but still describes it simply as a ‘variety of the constricted unguentaria of Form 8’ (Isings 1957:

41, Form 27). For the purposes of this study, these were all recorded under Form 8, since distinguishing the two is often impossible, unless the full vessel is present, and they all serve the same function. Fragment analysis led to an estimate of 44-45 Isings Form 8 vessels, with one of these possibly being the top of another form of unguentarium. This count makes tubular unguentaria the second most common blown vessel form identifiable in the Usk assemblage. Most of these were natural blue-green (Table 3.10) but there was one dark green example – although this had a more globular body than most, which could make it Form 26 or 28 (Isings 1957: 40-43; Appendix 1.C.8).

The next most prominent unguentarium form is Isings Form 28, which has 11 examples (Isings 1957: 41-43), followed by Isings Form 26, with two examples. A further six unguentaria that could not have their forms specified. One possible addition to the tubular unguentarium group is item 82.10H/283 (Price 1995: 176-177, No. 95, Fig. 45), which is simply a tubular piece of blue-green glass flaring slightly at the top and bottom, but there is a possibility that it is not an unguentarium at all. Price suggests that this may be a funnel of Isings Form 74 (Isings 1957: 92), which would make it the only one of its kind at Usk (Price 1995: 174).

Table 3.10: Colour and form distribution of unguentaria from Usk

Colour	Blue-green	Dark green	Light green	Yellow-green	Dark blue
Isings Form 8	36	1	1	6	1
Isings Form 28	11	-	-	-	-
Isings Form 26	1	-	1	-	-
Undefined	6	-	-	-	-

3.2.2.2.8 Amphoriskoi

There is only one potential amphorisk recorded at Usk (Appendix 1.C.9). Price's item 115 (Price 1995: 182, Fig. 47) is reconstructed from 49 blue-green fragments of body, base, neck, rim, shoulder, and handle attachment that were scattered over five levels of a pre-Flavian fortress pit[50] (Manning 1989: 94, 96, & 98). Its reconstructed height is 23.2 centimetres and it has an ovoid body, an open ring-base with concave centre, and an everted, tubular rim. It matches Isings Form 15, which appeared in the Tiberian-Claudian period, and which became popular as tableware in the Claudian-Neronian period. Widespread use of this form continued throughout the first century and there is no indication that it was of high status (Isings 1957: 32-34).

3.2.2.2.9 Jars (Appendix 1.C.10)

The Usk assemblage presents a large number of glass household storage and transport containers. The presence of large numbers of these vessels is unsurprising given a trend that Cool and Baxter spotted in Romano-British glass use. They observe that military settlements made heavier use of these vessels than civilian sites. Although there is no civilian assemblage available to compare directly to Usk, the need for these containers in the army makes logical sense. Civilians, in Britain, may have still had a primarily local diet, where soldiers might have desired imports from the parts of the Empire from which they came (Cool and Baxter 1999: 84). Additionally, civilians likely had less need to purchase, and store, large quantities of goods at one time, where the army would require large quantities of foodstuffs, and would need food reserves as well as immediate supplies to send out with patrols or campaigning troops.

At least 47 jars are represented in the archaeological record of the Usk fortress (Table 3.11). The majority are of two varieties of bulbous or ovoid jars with vertical collar rims. These were common in Neronian and early-Flavian Britain, but disappeared by the end of the first century (Price 1995: 169-170; Isings 1957: 86-88, Form 67). Of these Isings Form 67 jars, 24 are examples of variant *c*, which is identified by vertical

[50] (LAE (1) unstratified, LAU (2), LBC (1), LBE (2), and LBG (3)

ribs on the body and a pronounced open-ring base. There are an additional 12 examples that have no preserved ribs that may be of variant 67b, which has a vertical collar rim, but no ribs, and an indented base without the pronounced open ring.

Table 3.11: Colour distribution of Isings Form 67 jars from Usk.

Colour	Blue-green	Dark blue	Yellow-green	Light green	Yellow-brown/amber	**Totals**
Isings Form 67b	9	2	-	-	1	**12**
Isings Form 67c	14[51]	4	3	2	1	**24**

There are 13 fragments of 10 vessels representing forms of jar with funnel mouths. One of these consists of a portion of a rim and a separate handle fragment (Price 1995: 171, No. 78). This could potentially make it an amphora shaped jar such as Isings Form 65 (Isings 1957: 84-5), but there is no trace of where the handle connects to the vessel below the tiny rim fragment, so it cannot be said with certainty that these come from the same vessel. The other funnel shaped rims have no traces of handles. This could mean that they are a form such as Isings 64, where the handle sits on the shoulder (Isings 1957: 83-84), or that this is a form with no handle, such as a square jar (Isings 1957: 81, Form 62), or a convex jar with an out-turned rim (Price and Cottam 1998: 143-144, Fig. 62b). There are comparable rim fragments from late first and second century contexts in Nijmegen and at Colchester, but these fragments have not been assigned to any specific vessel form (Cool and Price: 1995: 114-115, Nos. 844-8; Price 1995: 171).

3.2.2.2.10 Bottles (Appendix 1.C.11)

Most of the household storage containers found at the Usk fortress were bottles of either prismatic (usually square) or cylindrical forms (Isings 1957, Forms 50 and 51).

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[51] Price's items 71r and 71s (Price 1995: 170) are being counted as one vessel because they both come from feature LAL, a pre-Flavian fortress well. They were found in consecutive layers. The top of these layers contained late first century pottery. (Manning 1989: 94)

Both tall and squat variants of these forms are common at sites across the Empire from the second quarter of the first century A.D. through to the mid-third century, and they almost always come in natural colours (Isings 1995: 63-69; Price 1995: 185). Of the 199 fragments counted from Usk all are naturally coloured (Table 3.12). As with the storage jars, these bottles are utilitarian vessels and are well noted in military contexts (Cool and Baxter 1999: 84).

Isings Forms 50 and 51 are usually treated together, since they have the same functions, as storage and transport containers for liquids and semi solid foods, as well as for cinerary urns, and the forms are indistinguishable from the rims, necks, and handles (Price 1995: 185). These vessels were generally plain, with no decoration except the vertical combed ridges on some of the handles, but the occasional example does have some moulded design in the form of base mouldings. There are three exceptions to this lack of decoration among the bottles from Usk. First, are fragments of at least one yellow-green cylindrical bottle that suggest that his bottle had two broad, wheel-cut lines on the body bordered with abraded bands, and a bulging shoulder where it meets the body. Then there are two blue-green unpublished fragments, one of which is a neck (82.11H/388), and the other a rim, neck, and handle attachment (82.11H/379) both have ridged bands around the top of the neck.

Table 3.12: Colour distribution of bottle fragments from Usk.

Colour	Fragments	MNI Vessels
Blue-green	115	64
Pale blue	37	12
Yellow-green	24	1
Pale green	23	7

Cylindrical bottles could be produced by blowing them into a one-piece mould, or by free-blowing, and they generally have concave, undecorated bases (Price 1995: 185). There were over 79 fragments of cylindrical bottles found at Usk, but only 28 come from Fortress-period deposits (Price 1995: 185). Out of these, one can only be certain of a minimum of five individual free-blown vessels. Prices' item 123, may be residual, or may have been used beyond the occupation of the fortress, because it was found in a ditch of the small Flavian fort built on the old fortress site. It still likely falls into the relevant time period for this study, as the fort and its goods still fit into the study period, and scratches on the body and wear on the base suggest that this item was in use for some time before it was broken and discarded (Price 1995: 185, Fig. 48). It may even have been lost during the fortress period and simply disturbed during the digging of the fort's ditch. It is not overly surprising that Form 51 bottles are sparse in the fortress period, because the cylindrical form was rare in early bottles, gaining in popularity in the Flavian period and throughout the second century (Isings 1957: 67-8).

Prismatic bottles were much more prolific at Usk. Price cites almost 300 fragments of this type – although it appears that this number includes rims, neck, and handles, which could potentially have been attached to cylindrical bodies – but only 171 of these were found in Fortress-period contexts. From these 171 fragments, at least 79 vessels were identifiable. Of these, at least 44 were definitely prismatic, and at least one of those was of the rare, Claudian-Neronian hexagonal variant. The hexagonal fragments were found across four separate contexts meaning there is the potential for more than one vessel of this variant[52] (Isings 1957: 64; Price 1995: 190, No. 136, Fig. 49; Price 1993: 75). Isings (1957: 64) stated that all prismatic bottles were mould-blown, but it is also possible to get a square body form by pressing the vessel on a marvering table. Price notes that marvering does not produce as sharp right angles as a multi-part mould does (Price 1995: 185), and mould-blowing appears to have been the dominant method of production for Form 50 bottles at Usk. Most of the wall fragments examined had the smooth interior and slightly textured exterior that is produced by

[52] There is not enough variation or redundancy between fragments to claim that there were four distinct vessels.

contact with a mould, and 20 examples have base mouldings. Most base mouldings are simple raised right-angle shapes at corners, concentric circles, and circular pellets.

Two of the base fragments had moulded writing. Catalogue number 130 had 'L' shaped mouldings in the corners, a letter 'I' part way along the side of the base, and what may be the right diagonal bar of a letter 'A' (Price 1995: 190, Fig. 49). Bottle base number 124 is much more complete, it bears the full legend 'CHRESIMVSΔFECITΔ' with triangle stops separating the words. The legend is arranged in a circle between two of the four concentric moulded rings (Price 1995: 188, Fig. 48, Plate XV). This bottle may be indicative of continental trade goods reaching frontier fortresses, supporting Cool and Baxter's (1999: 84) idea that soldiers sought imports to maintain a 'Roman' diet, because the name Chresimus is also present on a bottle base from the legionary fortress in Xanten, Germany (Section 5.2.2.2.8). Since both examples are square storage and transport containers, they may both be imports and their point of origin is uncertain. Additionally, neither can be taken as an indicator of glass trade patterns, because they would have been traded on the basis of their contents, not for the reason of being desirable glass vessels.

Six of the prismatic bottles cannot be definitively identified as mould-blown,[53] but when including all the evidence of base mouldings, mould marks, and wall texture, it can be concluded that at least 44 of the 84 storage bottles at Usk were mould-blown. Considering that 35 of the total number of bottles were not represented by enough, or by the right kinds of fragments to label them as either Isings Form 50 or 51, it stands to reason that there were likely many more mould-blown, square bottles represented among the total of 84 vessels.

[53] Four were base fragments without mouldings and two were wall fragments will ill-defined textures. One of them (82.11H/51) was badly heat damaged.

3.2.2.2.11 Unidentifiable

In addition to the vessels with recognizable form and function, there are at least 218 fragments of Roman glass from the fortress period that cannot be matched to any recognisable forms or with other glass from their contexts. These represent approximately 132 additional vessels, all but 17 of which are in natural colours. There is one brown fragment from the fortress defences (9955H/7), and all the rest of the coloured fragments are of the solid dark blue glass that was among the most common colours of the early first century. Most of the unidentifiable vessels are represented by unremarkable body fragments. Some notable exceptions are: one blue-green fragment with ridges (82.10H/237); two fragments that may be large ribs or handle attachments, but are damaged beyond recognition (82.11H/438, and 82.11H/251); and one ridged fragment with almost no curvature that is labelled as a rim, but looks more like a ribbon handle (82.11H/255). Four of the dark blue items have some decoration, but it is not helpful to identify the vessels. 82.11H/470 has trailed ribs but is badly worn, 82.11H/113 has one pinched vertical or spiral rib, 82.10H/66 has a ridge below what appears to be a vertical fire-rounded rim but is by no means certain, and 82.10H/290 has ridges on what appears to be a body fragment.

Most of the unidentifiable vessels were free-blown glass, but two were mould-pressed, and the dark blue fragment with trailed ribs might be cast as well, but the wear made it impossible to be certain. There were also seven unidentifiable fragments that had textures that suggested mould-blowing.

3.3 Patterns

In total, the legionary fortress at Usk has turned up an estimated minimum number of 720 vessels (Table 3.13). Approximately 87 or 88 (12.2 per cent) were cast vessels, of which 73, or 84 per cent, were pillar-moulded bowls. Mould-blowing was responsible for at the very least 60 vessels (8.3 per cent), but of these only nine vessels were recognizable as tableware with an additional seven unrecognizable vessels meaning that mould-blowing accounts for slightly more than two per cent of the vessels without counting the storage bottles. The remaining 79.4 per cent of vessels were produced by free-blowing.

Table 3.13: Glass vessels from Usk sorted by production type.

Production Category	Technique	MNI vessels	Percentage of Total Glass
Casting	Pillar-moulded	83	11.5
	Other casting	2	0.3
	Unclear method (cast)	3	0.4
	Total cast glass	**88**	**12.2**
Blowing	Free-blown	572	79.4
	Mould-blown	60	8.3
	Total blown	**632**	**87.7**
Total Vessels	**All methods**	**720**	**100**

Tableware for drinking and eating makes up at least 35 per cent of the glass from the fortress-period, but no doubt would have greater numbers if some of the unidentified vessels were defined. If unidentified vessels are excluded, eating and drinking vessels could make up 43 per cent of the vessel assemblage. When adding serving vessels such as jugs and the amphorisk to the tableware category, its portion of the total assemblage goes up to 47 per cent, and tableware reaches 61.6 per cent of all the identifiable vessels (Fig. 3.14, Table 3.14).

Toilet containers such as flasks and unguentaria make up approximately 12.6 per cent of the assemblage, and 16.6 per cent of identifiable vessels; and storage containers, such as bottles and jars, make up 16.4 per cent of the assemblage, or 21.5 per cent of all identifiable vessels.

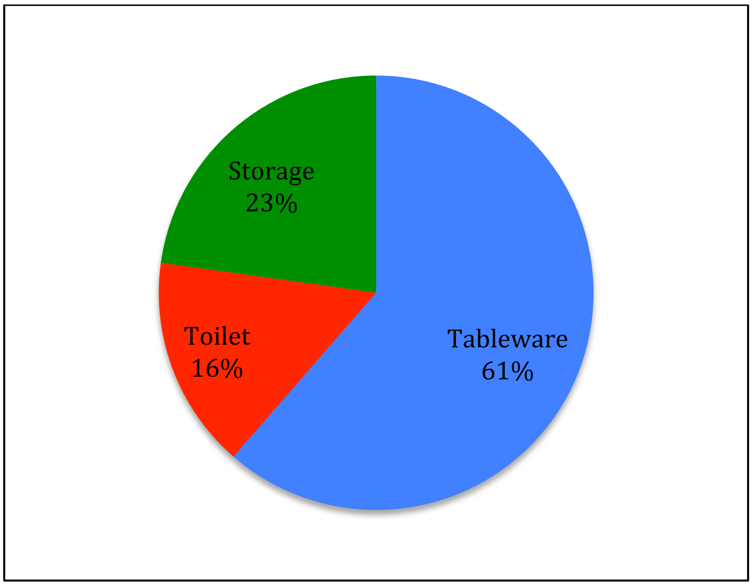


Figure 3.14: Usage category proportions among identifiable vessels from Usk.

Table 3.14: Usage category distribution in the Usk assemblage.

Tableware		Toilet Vessels	Storage Vessels	Unidentified
Eating and drinking	Serving	93	134	132
254	107			
361				

While there is currently no research that allows for a direct comparison between Usk and an associated civilian settlement, it is possible to observe how civilians used glass in the same region. The replacement fortress at Caerleon, has a well documented *canabae* (Evans 2000), which has an substantial glass collection of over 1300 vessel fragments. This assemblage extends beyond the time-frame of this thesis, but there is a potential overlap with the Usk fortress, and was certainly occupied in the Flavian period. The Caerleon *canabae* again shows a strong preference for blown glass relative to cast glass, most of which would have been utilitarian, as 1050 fragments are natural blue-green (Allen 2000: 424-443). There are only 18 cast vessels, making up just 2.76 per cent of the published assemblage, and they are all open forms categorised as cups, bowls, and plates. This level of cast glass is substantially lower than that in the Usk fortress, but is very likely influenced by the presence of second and third century blown material. Of the cast vessels, nine examples are pillar-moulded bowls. The remaining 633 vessels (97.23 per cent of the vessel assemblage) are blown vessels. The vessel type distribution is substantially different from that in the fortress, with cups bowls and plates only making up about 14.75 per cent of the assemblage, excluding 24 bases that could come from a variety of vessel types, as opposed to a minimum 35 per cent in the Usk fortress (Allen 2000: 424-443). It is not clear as to how many vessels might be considered luxury items without carrying out a detailed personal study of the material, but there are a few examples that stand out including some facet-cut vessels that are possible successors to the mould-blown gladiator cup tradition. There is a chariot race scene on a beaker, believed to be of Flavian date, from the amphitheatre (Allen 2000: 431; Wheeler and Wheeler 1928: 170; Boon 1967: 98), and then two later examples, which post-date the relevant period of study (Allen 2000: 431).[54] The only other form to stand out is represented by two examples of a colourless late first- or second-century bowl with folded ridge around the body akin to Isings Form 69b. This form appears in the Flavian period, and Allen (2000: 426, 428) describes it as a blown imitation of the strongly coloured carinated bowls of the early first-century.[55] The fact that these bowls are colourless may suggest that they were luxury items, and an example found in a fourth century grave at Trier seems to indicate that it was valuable enough to have been saved as an heirloom (Goethert-Polaschek 1977: 37-38).

3.4 Distribution

The distribution of glass finds and patterns of glass usage are difficult to calculate at Usk. Glass is found across most of the site, and locating find contexts is sometimes nearly impossible. Several of the find contexts were features that have been omitted from the final 1981 and 1989 publications because 'they were felt to be too

[54] One chariot beaker comes from a second century context and has been attributed to a group of vessels made in Köln (Allen 2000: 431) Fremersdorf 1951). The second vessel is a flask, with a sport scene, which may date as late as the third or fourth century (Allen 2000: 431; Boon 1967).

[55] Bowls with tubular folds in the upper wall are known across the western Empire including examples at Velsen II, in the Netherlands (van Lith 1977: 55); Cosa, in Italy (Grose 1974: 44); and Trier, Germany (Goethert-Polaschek 1977: 37-38)

insignificant to justify detailed discussion' (Manning 1995: 348), and the feature documentation system does not make it possible to work out exactly where some of those contexts were without having Manning's original excavation notes. Distribution may not expose much about the usage anyway, since most of the vessels are represented by a small number of scattered fragments, and most forms are found in many different contexts. Additionally there is the problem of the demolition of the fortress, which would have resulted in the removal of most objects from their use context, although it is possible that some buildings would have been pushed over in place, sealing in items that had not been worth removing (Allison 2013: 53). It can be argued that, due to the small number of fragments per vessel, glass was likely being collected for recycling, and therefore, numbers here likely underestimate the vessels that were actually used within the fortress. The collected material from Usk also provides six examples of glass production waste from five different features to support the argument that there was production somewhere at Usk, for which broken glass was collected (Inventory Nos. 82.11H/149, 82.11H/250, 82.11H/63, 82.11H/202, and 82.10H/272). A workshop has, however, never been identified.

Only a few vessels reveal much about distribution, and those are rare items that are highly decorative. The green *millefiori* bowl 82.10H/6 (Price 1995:143, No. 2) comes from a context that may help to determine its role. The pit 'LMG' was located at the western edge of the fortress, and may have been a site for dumping waste for the suspected officer's house that lay immediately east of it (Manning 1989: 110-113, 164, plan 39) (Fig. 3.6, Section 3.2.1.1). Cast *millefiori* wares would have been time consuming to produce and would have been far more costly than most utilitarian blown items, so one might expect these items to belong to someone of high status. The other two to six possible *millefiori* vessels also come excavations in the western side of the fortress in and around the area of the modern cattle market (Manning 1981: 133; Manning 1989: 5, 60, 62, 84). This area covers the colonnade and houses south of the *via principalis*, so if these items are high-status then they may have been found close to their places of use, but they were scattered across numerous contexts, discussed above, so they had all been lost or discarded outside of their immediate usage area. The single amphorisk from Usk was also found in this area of the fortress making it a possible luxury item as well (Manning 1989: 94, 96, 98).

There is currently no evidence for any of the glass in the assemblage having been collected for the purpose of future recycling, and there is no evidence for a glass furnace within the fortress. The vast quantity of utilitarian glass does, however, suggest that much of it was produced nearby if not in the fortress itself. Considering that only about between 25 and 40 per cent of the roughly 208,000 square metre fortress has been fully excavated and the rest remains covered, or disturbed by modern construction, it is far from inconceivable that a one-meter in diameter glass furnace or a cullet collection point has simply not been identified.

3.5 Relationship to Pottery

The pottery from Usk is published in two volumes, *The Pre-Flavian Fine Wares* (Greene 1979), and the more general *Roman Pottery* (Manning 1993) volume containing the Kevin Greene's section on the coarse ware, and Tyers' and Johns' sections on the Samian ware. If one wants to compare this pottery to the glass at Usk, it can only be done in a broad sense, because glass was recycled on a much wider scale than pottery, and most glass recycling actually destroys evidence for previous objects in the forming of something new. Pottery recycling uses the broken sherds for other purposes, such as aggregates in concrete, and the sherds themselves are preserved. The glass will almost always be under-represented, and the pottery count will greatly exceed the glass.

If one is to compare glass storage containers such as bottles and jars, at Usk, to coarse ceramic vessels it is obvious that the numbers are not even close and that glass was not eclipsing pottery or affecting the ceramic market for this purpose. The Usk collection contains at least 134 examples of glass storage containers, but looking solely at coarse ceramic rim sherds, there is an estimated minimum number of 3000 securely stratified Neronian-Flavian vessels (Greene 1993: 4), of which there are a minimum of 1,265 jars, nine pitchers, and four *dolia* that appear to be from local fortress production alone (Greene 1993: 10). Beyond that, there are over 139 amphorae (Greene 1993: 51) that would be used for storing and transporting many of the same items as the Isings Form 50/51 bottles. When combined with wares that were not locally produced, Greene (1993: 79) came up with 1,815 storage and kitchen vessels, which includes jars, pitchers, amphorae, *dolia*, and also some cooking vessels. Even if the glass storage vessels are only compared to the fortress-produced storage vessels the extant fragments represent no more than 9.5 per cent. While we can be quite sure that more glass vessels of these types were used at the fortress, they will still only be a small percentage of the total containers used for storage.

Tableware is the more interesting comparison to draw, as table vessels make up over 61 per cent of the glass finds, and it is tableware that are relevant to Stern's comparison of glass outnumbering thin-walled ceramics at Pompeii by a ratio of 2 or 3:1 (Stern 2004: 103). Such a ratio appears unlikely at Usk as the pottery vessels far exceeded glass in terms of the fortress' tableware (Fig. 3.15). If a simple comparison is made between glass eating and drinking vessels and the ceramic fine-ware, the result is 255 glass vessels to 291 pottery vessels. This estimate already places pottery numbers above glass numbers and excludes the other categories of pottery. There were 216 coarse drinking vessels, 25 coarse tableware bowls, 244 plain Samian cups, and 52 miscellaneous plain Samian bowls and table settings (Greene 1993: 79; Tyers 1993: 131). There are at least a further 275 fragments of published, decorated Samian wares, which are estimated at only 23 per cent of the total decorated Samian finds (Johns 1993: 163), plus over 291 fine wares (Greene 1979). This forms a total of more than 828 eating and drinking vessels without even counting the decorated Samian for which there was no published estimated vessel count. If tableware is broken into the categories of pouring vessels, eating and drinking vessels (bowls and cups), and plates (Samian and Pompeian Red) the pottery outnumbers glass by a large margin in each case (Table 3.15). Only by taking all of the glass tableware together is it possible to get a number greater than the fine pottery to come close to the lower end of Stern's 2 or 3:1 glass to ceramics ratio. That would have to assume that all the unidentified glass fragments come from tableware, which is by no means a safe or appropriate assumption to make.

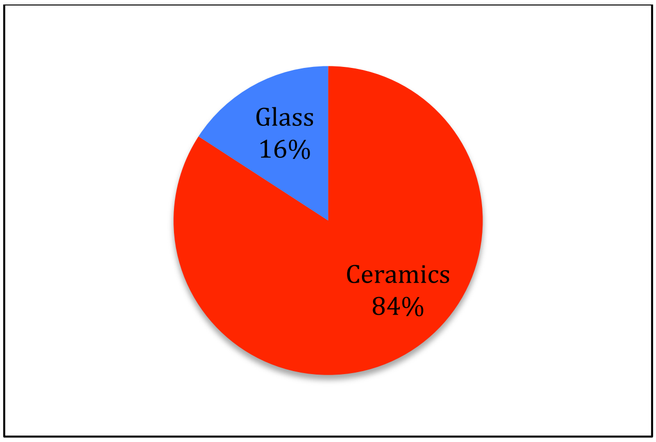


Figure 3.15: Percentages of glass and ceramic tableware at Usk.

Table 3.15: Comparison of ceramic and glass tableware numbers. (Greene 1979; Johns 1979; Tyres 1979).

Category	Ceramics	Glass
Pouring vessels (fortress period coarse-ware)	256	107
Eating and drinking vessels (bowls and cups)	1,359	255
Plates	331	4

The pottery may provide useful hints about the trade networks active in connection to the region in which the Usk fortress was located, as pottery can be used as an indicator of trade in commodities that are unseen in the archaeological record,[56] and the distinction between local and import wares can illustrate the market catchment area for an individual site (Fulford 1987: 59-60; Fulford 1978; Hodder 1979: 193-194; Hodder 1974a; Hodder 1974b). This information does not, however, help much with understanding the glass trade in the region. In the Usk example there are types of coarse wares that have been identified as locally produced fortress wares (Greene 1993) and there are also examples of *Sigillata*, and Samian wares from Gaul and Italy, as well as Pompeian red wares (Johns 1993; Tyers 1993). These examples cannot pinpoint where any specific types of glass vessels came from, but illustrate the range of possibilities. The fortress coarse wares show that there were fire-based industries at work, and capable craftsmen in the vicinity of the fortress, indicating at least the potential that some glass may have been worked locally. Pottery from other regions show that the legionaries stationed at Usk, and in comparable frontier regions, had access to trade routes that allowed them to obtain items produced throughout the Empire. The absence of clearly distinguishable regional glass vessel forms in the first century A.D., the ability to work glass great distances from the raw material sources, and the relative lack of variety in raw glass production locations distinguish the glass industry from the ceramics industry. These factors make tracing the glass almost impossible, even when there are clues into the broader trade networks of a region.

3.6 Conclusion: Contextualising the Data

The legionary fortress at Usk shows, without a doubt, that glassware was heavily used in Britain immediately following the conquest and that the Roman invaders

[56] Amphorae can be useful tools to track trade in wine, oil, and other goods transported within them.

brought the same styles of glassware that was being used on the continent, including production types that predate glassblowing. The glass assemblage at Usk is impressively large for a site that was only occupied for about two decades. The Usk assemblage rivals those from sites that were occupied immediately following the conquest and became major urban centres as well as just fortresses, such as Colchester. In fact, there are more fragments dating to the fortress period at Usk than there are at Colchester from all contexts before A.D. 80 (Cool and Price 1995: 11, Table 1.4). This number may, however be skewed because of Colchester's continued occupation and glass-working, which would have made use of the broken glass, where little of the glass at Usk would have had time to be recycled and enter a new phase of use before the fortress was abandoned.

The Usk assemblage provides strong evidence that glassblowing was the heavily preferred technique by the time of the conquest of Britain, in A.D. 43, but that older casting techniques were still useful and inexpensive enough to continue spreading a century after the invention of glassblowing. The assemblage shows that the pillar-moulded form, which arose before glassblowing, was still a dominant form, and was being used to produce vessels for a wide market. That being said, the total proportion of slumped, pillar-moulded bowls to the entire body of glass at the site strongly suggests that this method was not the primary driving force behind the spread of the glass industry to the Romano-British frontier. Glassblowing produced far more vessels, in a far greater variety for Rome's new province of Britannia than casting techniques.

The number of utilitarian, cast vessels is evidence that glass casting was not restricted to luxury items. In fact, the Usk assemblage had more blown vessels that could be interpreted as luxury items than high-status cast vessels. Of the 73-77 individual pillar-moulded bowls only three to seven examples bear decoration that could suggest that they were luxury items, and 57 were made of the standard utilitarian blue-green. If the polychrome bowls and the cast plate were actually 'luxury' items, cast luxury vessel reach a total of between four and eight vessels, depending on whether or not some of the blue polychrome fragments are from the same vessel. This compares to around 15 blown vessels that could be considered potential 'luxury' items based on colourless glass, decoration, or forms that are unusual in glass or in Britain. This potential 'luxury' vessel count is a lower percentage among the blown vessels at Usk than among the cast vessels, but the numbers show that cast vessels were not inherently more costly or high status than blown vessels. Additionally, the strong presence of natural coloured utilitarian cast items show that there was no reason that cast glass could not have been accessible to a wide audience, spanning most, if not all of the Roman social spectrum.

Comparisons between Usk and other sites, like Colchester show that Usk is not out of place in the context of Roman Britain. At Colchester, like at Usk, large bowls including the pillar-moulded bowl form are among the most common mid-first century forms by a substantial margin (Table 3.16). The combined results of the fort and *vicus* at Castleford also show a high proportion of pillar-moulded bowls, which have been noted to be common in sites with a strong military presence (Table 3.17). Castleford surprisingly shows that pillar-moulded bowls made up a greater percentage of the *vicus'* assemblage, but the results are based on a small sample size.

Table 3.16: Glass vessel types from Colchester AD 44-60/61 (by EVEs) (After Cool 2006: 179: Table17.4).

Vessel Type	Total Glass EVE A.D. 49-60/61
Large bowl (including pillar-moulded bowls)	13.60
Cup	5.60
Jug	4.20
Jug/flask	3.60
Beaker	3.20
Bowl (other)	3.20
Bottle	2.24
Cantharus	0.60
Jar	0.55
Amphorisk	0.28
Total	37.07

Table 3.17: Glass vessels from Castleford based on EVE data: Fort I vs. *Vicus* phase 1 (After Cool 2006: 188, Table 17.8).

Forms	Fort	*Vicus*
Drinking vessel	2.40	0.20
Pillar-moulded bowl	2.00	1.20
Other bowl	0.40	–
Jar	0.39	–
Jug	0.42	0.42
Bottle	2.24	0.28
Total	7.65	2.10

The Usk excavations also illustrate that pottery was the dominant form of vessel production and that glass was supplementary, rather than a replacement material in this frontier context. The total estimated minimum number of fortress-period glass vessels excavated only reaches 24 per cent of the fortress-period coarse ware. Even recognising that glass recycling and the decay of glass means its numbers are under-represented, we cannot make any strong arguments for the total number of glass coming anywhere near half of the total numbers of ceramic vessels that would have been used at the Usk fortress. This pattern falls in line with other British sites such as Kingsholm, Caerleon, and Colchester (Price and Cool 1985; Nash-Williams 1932; Cool and Price 1995), which all had access to wide trade networks giving them access to glass works and raw materials. Nonetheless, there was no case in which glass threaten the pottery industry on the British frontier.

Chapter 4 : Nijmegen: A Comparative Study of the First Century Kops Plateau Fort and *Oppidum Batavorum*.

4.1 Introduction: The Site

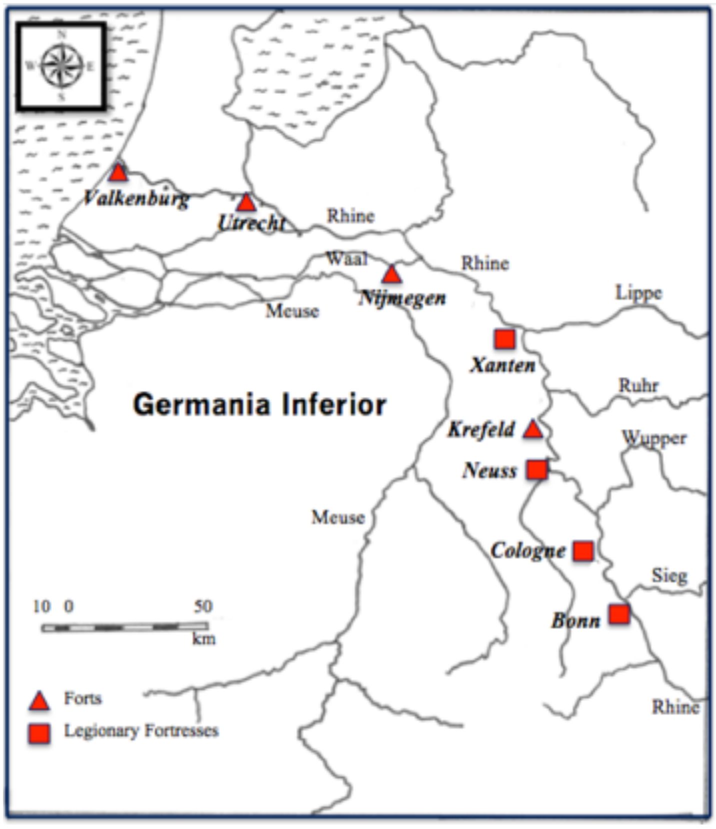


Figure 4.1: Roman fortifications in *Germania Inferior* in A.D. 69-70 (After Johnson 1983: 262; Lendering and Bosman 2012: 96).

The modern city of Nijmegen the site of a Roman frontier fort and settlement guarding the northern edge of the province of *Germania Inferior*. It is situated between the river Waal, which flows out of the Rhine, and river Maas (Fig. 4.1), placing it in an excellent position to control trade along the border both into the heart of the continent along the Rhine and out to the sea. The city is best known for the second century town *Colonia Ulpia Noviomagus*, but Nijmegen was also home to three earlier sites (Fig. 4.2). A huge earlier legionary fortress, which could have accommodated two or even three legions was located to the east of the *colonia* site, on the hill now known as the

Hunerberg (or Hunnerberg). A smaller cavalry fort, which had been the original Roman camp, sat on the neighbouring Kops Plateau (Lendering and Bosman 2012: 76; Lendering 2009), and a civilian settlement, called *Oppidum Batavorum* after the local Romanised tribe known as the Batavi, was situated to the west of the fortress, on the St. Josephhof and Valkhof (Lendering 2003). The Roman authorities created this settlement for the Batavi on virgin soil (Lendering and Bosman 2012), so its history fits entirely within this period of study. The focal points for this study are the latter two sites, which were involved in the Batavian revolt of A.D. 69/70 and have clear destruction layers that provide sealed contexts for the material relevant to this thesis.

Figure 4.2: Locations of first century A.D. settlement in Nijmegen (superimposed on Google Maps).

4.1.1 Period of Occupation

The Roman presence at Nijmegen was established during the Augustan campaigns into Germania *circa* 19 B.C. with the construction of a temporary camp on the Kops Plateau and then a legionary fortress on the Hunerberg. This fortress, which acted as a base of operations for further advancement into the Rhineland, was abandoned and demolished after the death of Drusus in 9 B.C. and was re-established in the Flavian period with the arrival of *Legio X Gemina* in A.D. 70 (Lendering and

Bosman 2012: 173). In the interim, the cavalry fort on the Kops Plateau, which was extant during the time of the Hunerberg fortress, and had remained in use until its destruction in the Batavian revolt of A.D. 69-70, was the only Roman military presence at Nijmegen. It is, therefore, the site that best represents the use of glass in a military context for the bulk of the relevant time period. The *Oppidum* post-dates the initial Hunerberg fortress, having been in existence from *circa* 15 B.C. to A.D. 69-70, but it would have been the major trading partner for soldiers based in the cavalry fort on the Kops Plateau (Hirst: 2014; Lendering 2009).

4.1.2 Significance of Nijmegen to This Study

The study undertaken at Nijmegen provides an opportunity to study the use of glass in neighbouring military and civilian settlements and to look at how glass was adopted by local Germanic populations absorbed into the Roman Empire. This study will allow for a comparison these two different types of settlement within the same region and, when combined with the later chapter on Herculaneum and Pompeii, will enable us to see the differences and similarities in glass usage from the frontier, where civilian populations were composed of recently Romanised local tribes[57] mingling with soldiers, veterans, and camp followers, to fully Roman settlements in the heart of the Empire. Furthermore, Nijmegen is one of only a handful of clearly identified glass working sites in the first century A.D. (Fig. 4.3) (Grünewald and Hartmann 2014: 44; Hartmann and Grünewald 2010: 17). These sites are located in a part of Europe where vessel glass was virtually non-existent before the arrival of the Roman army, and glass arrived so suddenly upon their appearance that there is almost no regional variation in forms (Woolf 1997: 343).

[57] It has been argued that Nijmegen was built for the Batavi, but it was so Romanised that it never really became a Batavian town.

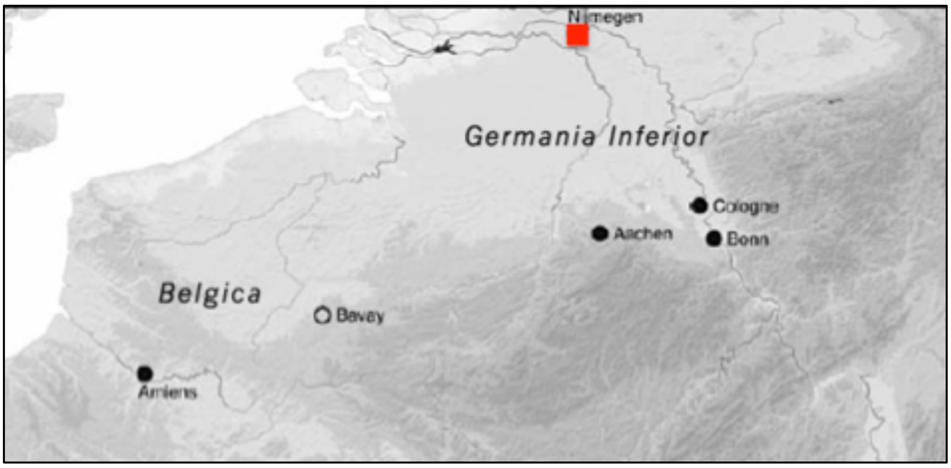


Figure 4.3: First-century glass working sites in northern Gaul and the Rhineland (After Hartmann and Grünewald 2010: 17, fig. 3).

The glass from Nijmegen has been the topic of some study, although the majority of work has not focused on the Kops Plateau or *Oppidum Batavorum* assemblages since they are from relatively recent excavations that had not been fully published at the time of this research and write-up. More work has been done on the early first-century fortress on the Hunerberg and on the later *Colonia Ulpia Noviomagus* (Brunsting 1937; Haalbos 1998; Haalebos 1991; Haalebos and Willems 1999; Kemmers 2007; Lendering and Bosman 2012; Willems and van Enckevort 2009). The majority of glass publication is on the second-century *Canabae* associated with the reconstructed fortress (Isings 1980). The Kops Plateau and *Oppidum Batavorum* sites, excavated in 1986-1996 and 2005-2006 respectively, have not been fully published and, at the time of analysis, feature types had not been catalogued, preventing a detailed study of contextual information. Additionally, no catalogue of the pottery has been published to provide comparison material. The glass itself, however, has been recorded in detail, by Sophia van Lith (2009). Her work is primarily a catalogue, focusing on describing the fragments and vessel forms that were present, but she drew some initial form comparisons between the Kops Plateau assemblage and two other frontier sites: Velsen and Valkenburg (van Lith 2009:12-13). Van Lith also produced maps of trench numbers for both of the Nijmegen sites included here (Figs. 4.4 and 4.5) (van Lith 2009: 40, 65);

an overview of the Kops Plateau site, with the locations of a few key buildings (van Lith 2009: 9); and some distribution maps for a few relevant forms (van Lith 2009: 41-44). Her maps have allowed for the creation of composite images and some distribution studies for this thesis, despite the absence of detailed feature information. This study will, therefore, be able to look at where certain forms were lost or discarded, if not definitively where they were used, to help identify any potential signs of status and patterns in the relationship between cast and blown glass.

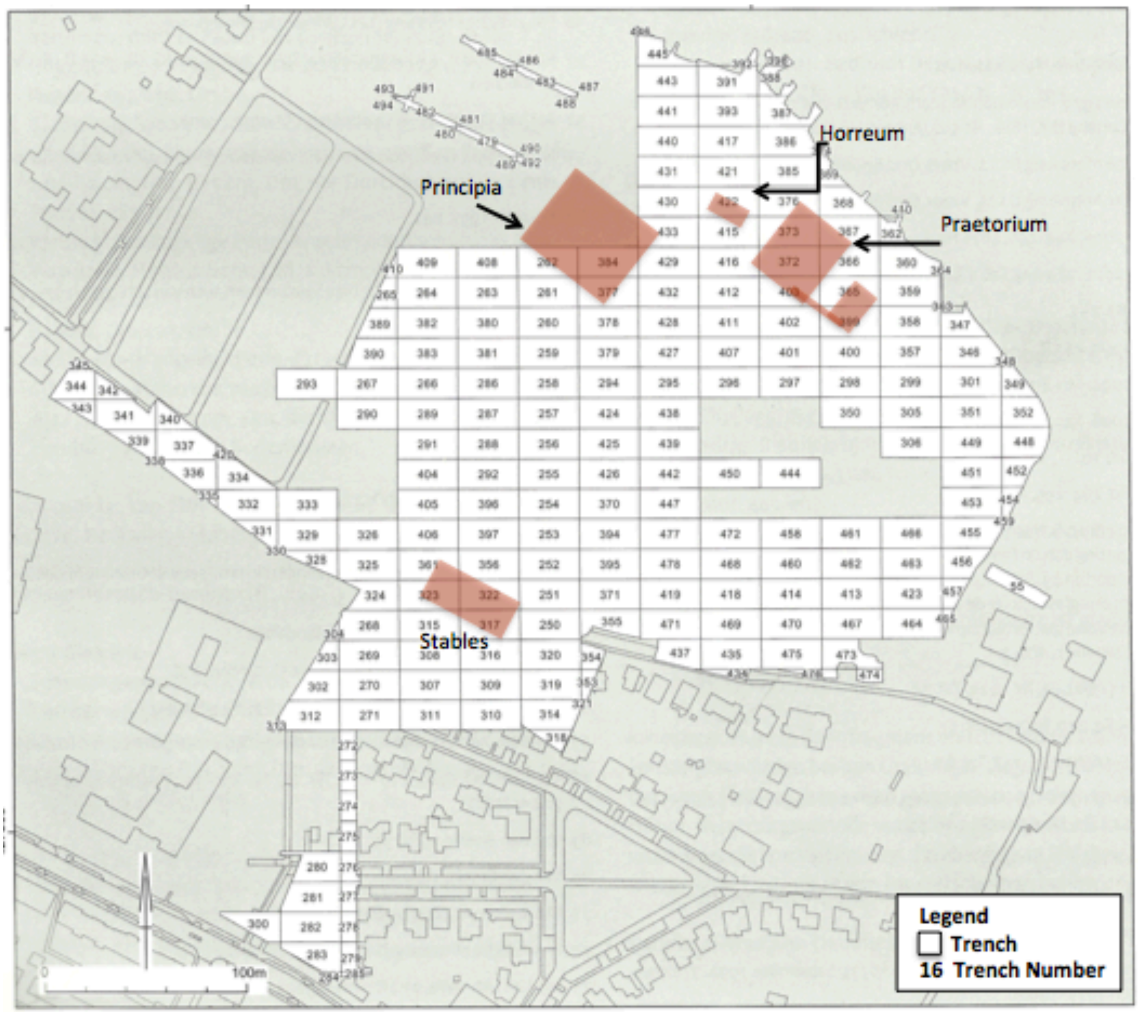


Figure 4.4: Excavation trenches on the Kops Plateau (Compilation of two different maps with added labels. After van Lith 2009: 9 and 40).

Figure 4.5: ***Oppidum*** **Batavorum 2005-2006 excavation trenches (After van Lith 2009: 65)**

4.1.3 Criteria Examined

This study will examine the contemporary glass assemblages found in the 1986-1996 excavations of fort on the Kops Plateau (Fig. 4.4) and in the 2005-2006 excavations of the civilian settlement on the St. Joseph hill (*Oppidum Batavorum*) (Fig. 4.5), which both predate the destruction layer from the A.D. 69-70 revolt. Each represented production type will be discussed in parallel allowing total percentages of individual production types to be compared, and the distribution of specific forms to be examined. Data was collected by studying the glass from both assemblages over a two-week period at the City Archaeologist's offices in Nijmegen and, as at each site in this thesis, details of fragments in each collection bag were recorded in a multi-variable spread sheet. This allowed for identification of the minimum number of individual vessels by filtering by vessel type; Isings Form, which was the categorisation system used in van Lith's publication of the glass from both Nijmegen sites; fragment type; colour; method of manufacture; decoration; find context; and size.

4.2 Types of Glass Production

As was the case in the Usk study, the majority of the vessel glass from Nijmengen was blown. The two Nijmegen sites do, however, exhibit some interesting differences, not just between them and Usk, but also between the two neighbouring social contexts. The Nijmegen sites allow for a comparison between military and civilian glass use at the same time period in the same geographical region to establish whether location, or other social factors had the most impact on vessel preference.

4.2.1 Cast Glass (Appendix 1.A)

Cast glass is found in noticeably different quantities in the civilian settlement and the cavalry fort from first-century A.D. Nijmegen, but in both settings there was a high percentage of pillar-moulded bowls among the cast vessels (Tables 4.1 and 4.2). In *Oppidum Batavorum*, there are 28 vessels that can be positively identified as cast, of which 19 are examples of the Isings Form 3 bowl (67.86 %). At the Kops Plateau fort 44 (77.19 %) of a total of 57 cast vessels were of this type.

Table 4.1: Cast glass forms from *Oppidum Batavorum*.

Vessel Type	Production Type	Number of Finds
Isings 1 Bowl	Cast	1
Isings 2 Bowl	Cast	1
Isings 1, 2, or 18 Bowl	Cast	1
Isings 3 Bowl	Pillar-moulded	19
Uncertain Cup or Bowl (Possibly Isings Form 3)	Cast	1
Uncertain Bowl or Plate Form	Cast	1
Uncertain Bowl or Jug Form	Cast	1
Isings 5 or 19 Plate/dish	Cast	1
Uncertain Plate Form	Cast	1
Uncertain	Cast	1
Total		**28**

Table 4.2: Cast glass forms from the Kops Plateau.

Vessel Type	Production Type	Number of Finds
Isings 2 Bowl	Cast	2
Isings 3 Bowl	Pillar-moulded	44
Isings 22 Bowl or dish	Cast	1
Isings 12 Cup/Bowl	Cast	2
Uncertain Dish Form	Cast	3
Isings 9 or 28 Unguentarium	Core-formed	1
Uncertain Tableware	Cast	4
Total		**57**

The selection of identifiable cast vessels is limited to a handful of vessel types. Open form bowls and plates, which could be formed through relatively quick and simple slumping or mould-pressing techniques, make up the majority of the cast vessels. The only exceptions are a potentially core-formed unguentarium from the fort, and one fragment, which appears to come from a bulbous jug from the civilian settlement. These exceptions could still potentially be from a bowl. Aside from the possibility of two closed-form vessels, the cast examples from both sites are the types of vessels that could have been formed using quick, cheap production methods proposed for the production of affordable vessels in David Grose's (1989: 241) argument that glass use was beginning to expand before glassblowing. Van Lith illustrates similar results in her comparison to the mid-first-century cast glass from Velsen and Valkenburg. Every cast example, from both sites, is a bowl, cup, or plate, which are all open forms that could be sagged. In both cases, pillar-moulded bowls were the best-represented cast form (van Lith 2009: 12).

Keeping Grose's argument in mind when looking at find locations from the Kops Plateau fort, it is notable that cast vessels were not confined to locations that would suggest use among only the wealthy elites (Fig 4.6), and few of the cast vessel fragments appear to come from highly decorative wares. Excluding, for a moment, the pillar-moulded bowls, there are only four *millefiori* vessels, and only one of these comes from the *Principia*, that being an Isings Form 2 carinated bowl found in the building's latrine (Table 4.2 and Fig. 4.7) (van Lith 2009: 15-16, No. 1). The remaining three are vessels of uncertain forms found outside of especially prestigious contexts. Two were found along the Road running south west from the front of the *Principia* (Fig. 4.6, trenches 259 and 261), but with no direct evidence tying the use of these objects to the command structure and the other is on its away from the other about 50 metres north east of the stables (trench 394) (van Lith 2009 16-17, Nos. 6-8). Only ten of the Isings Form 3 bowls were decorative polychrome patterns that would have been time consuming to produce, and they were not clustered in high prestige areas. Two come from trench 373 at the western corner of the *Praetorium*, and one comes from trench 377, which is just to the south of the *Principia*. The remainder are quite scattered around the excavation site, although four come from trenches loosely centred on the crossroad along the road from the stables to the *Principia* (Fig. 4.6, trenches 254, 256, 258, and 292) (van Lith 2009: 9, 17, and 40). The undecorated examples of this form was widely spread throughout the fort as can be seen from the distribution map below (Fig. 4.6) There is a small cluster at the *Praetorium*, including the two mentioned above but only one example from actually within the *Principia* (undecorated), and the majority are found outside of these structures, possibly discarded in pits or ditches along the fort's roads.

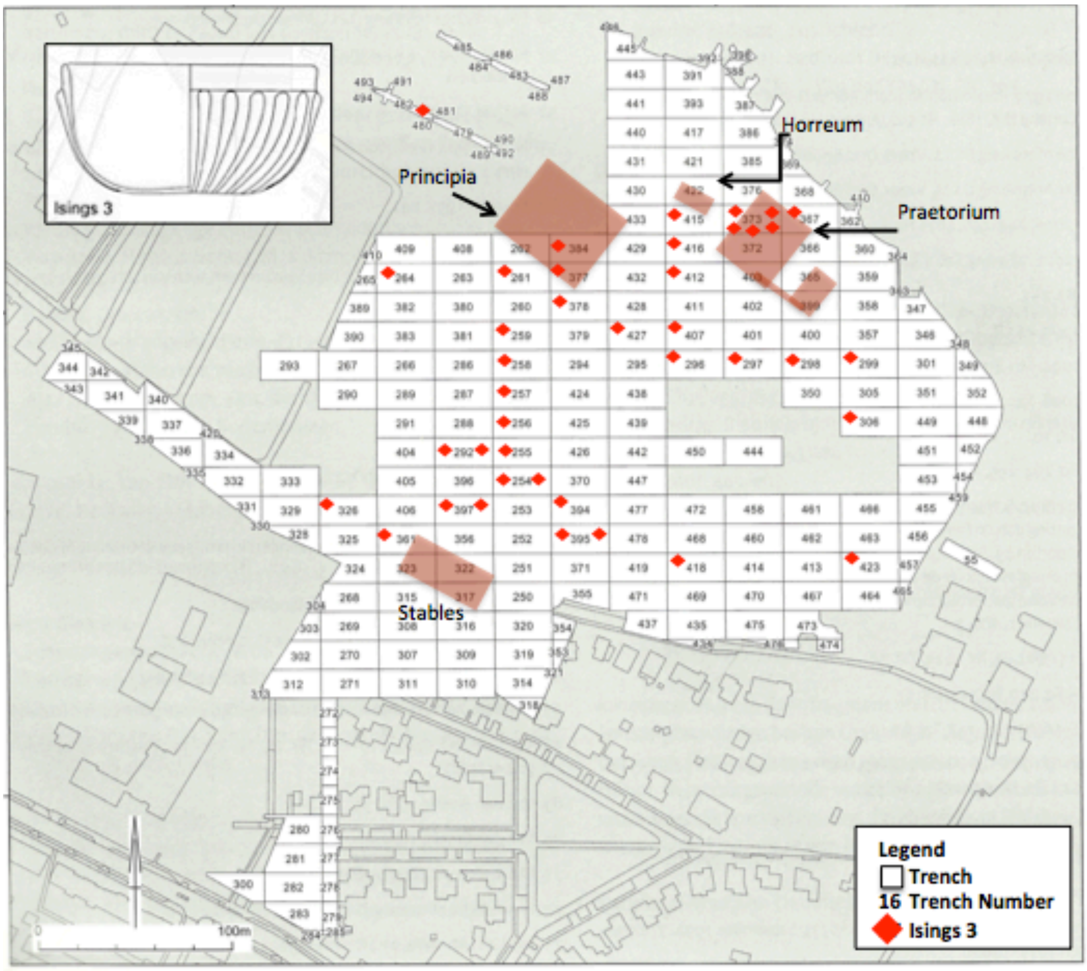


Figure 4.6: Distribution of Isings Form 3 bowls on the Kops Plateau (Compilation of two different maps with added labels. After van Lith 2009: 9 and 41).

Figure 4.7: Isings Form 2 Bowl KH/384/172 (Photo: Jonathan Prior with permission of the Nijmegen Municipal Archaeologists).

At *Oppidum Batavorum*, the cast vessel finds were spread around the site, with a concentration in trenches 2 and 3 (Fig. 4.8). There is no indication, however that these locations were particularly prominent residences, and aside from one example, which connects to a bowl in trench 21, around 50 metres away,[58] none of the decorative mosaic pillar-moulded bowls were found in or immediately around this concentrated find region. Without detailed excavation notes or feature information it is impossible to say whether buildings two or three were of a status that could allow its owners to use more glass than other locations, or whether they were production or sales locations, but there is a noticeable concentration of both cast and blown glass in these structures.

[58] The difference of about 50 metres between the buildings in which two connecting fragments were found helps to illustrate how far objects can be scattered from their point of use.

Figure 4.8: Isings Form 3 distribution at *Oppidum Batavorum* (After van Lith 2009: 65).

The only form that was surprising to see in a cast vessel was the hemispherical cup or small, deep bowl with wheel-cut decoration corresponding to Isings Form 12, which is typically free-blown. It is, however, an open form that fits with the other open form cast bowls discussed above and there is no reason that it could not be cast. Also, as shown by the majority of Isings Form 3 vessel rims and a number of lower interior fragments (van Lith 2009: 18, 19, 54. Nos. KH 29, 36, 39, 41 and Bat. 10a), it was not uncommon to have wheel-cut lines or abrasions on cast forms.

4.2.2 Blown Glass

Both assemblages were predominantly composed of blown vessels. Blown glass makes up more than half of each assemblage, but there is a marked difference in the amount by which it exceeds cast vessel numbers. In the civilian settlement, blown glass makes up 86.67 per cent of the total glass assemblage (Fig. 4.9), whereas the Kops Plateau assemblage is a mere 69.15 per cent blown glass (Fig. 4.10): a difference of 17.52 percentage points.

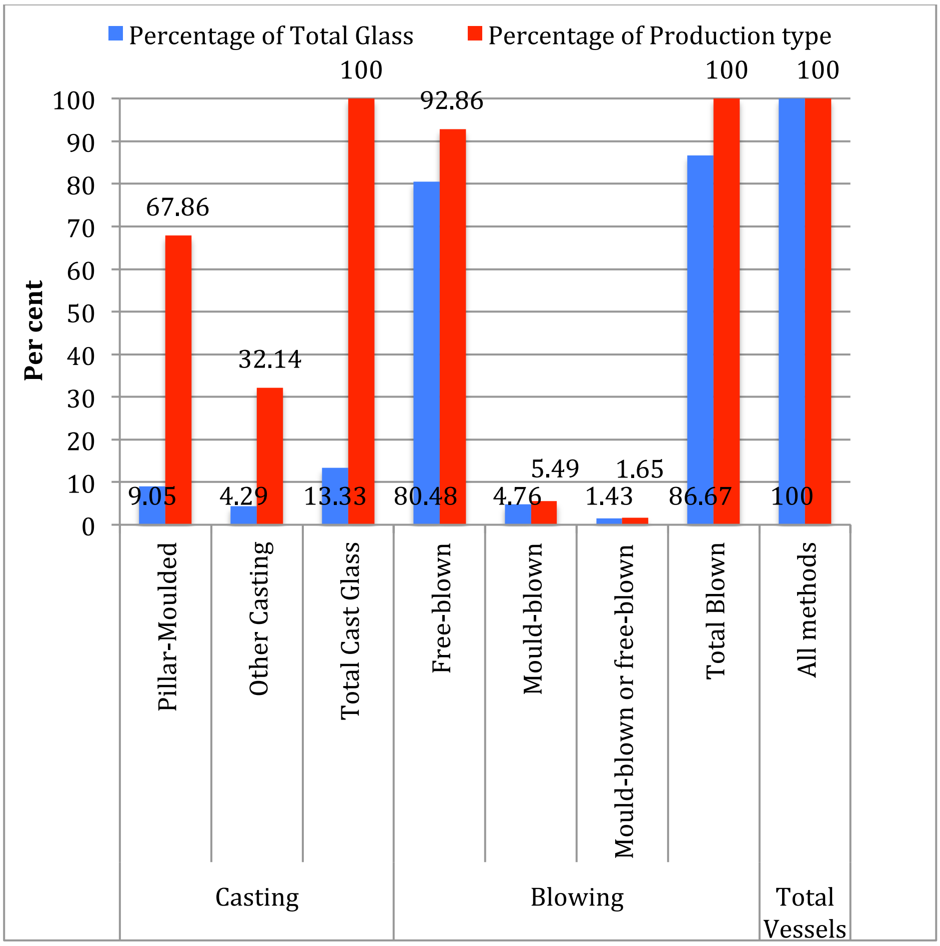


Figure 4.9: Glass assemblage percentages by production type at *Oppidum Batavorum*.

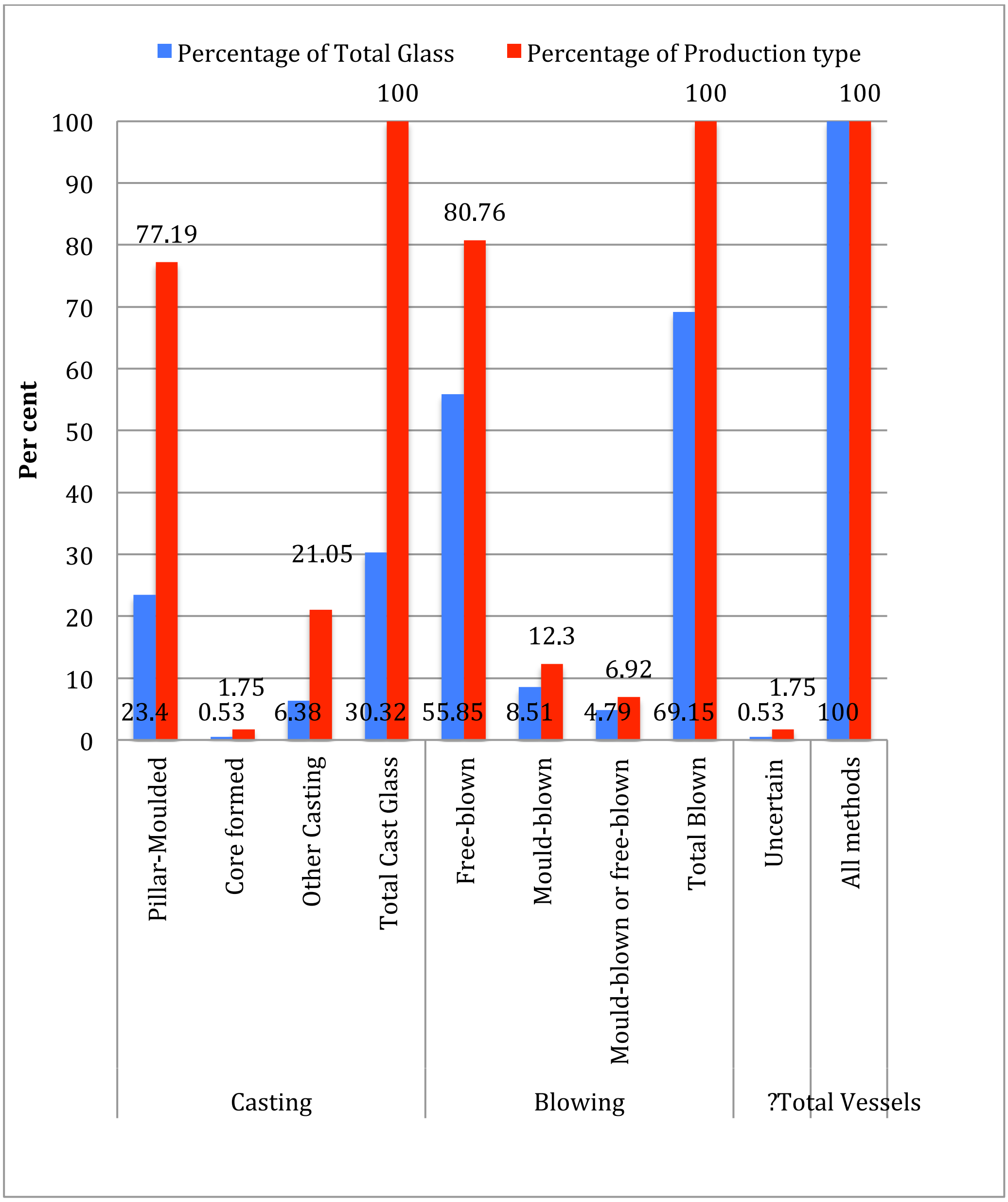


Figure 4.10: Glass assemblage percentages by production type at the Kops Plateau fort.

4.2.2.1 Mould-Blown

Mould-blown glass is a small minority of the assemblage in both Nijmegen sites, and there is little in the way of decorative mould-blown ware at either site. The mould-blowing technique is represented in less than ten per cent of each assemblage, although some of those whose production techniques cannot be positively determined could raise the mould-blown glass at the fort to almost 15 per cent.

4.2.2.1.1 Oppidum Batavorum

At *Oppidum Batavorum* the mould-blown glass is mostly in the form of utilitarian prismatic bottles, the only exceptions being one fragment of an unknown vessel type, two beakers, one cup or bowl and possibly one jug, which may just as easily be a cylindrical bottle.

Only three clearly mould-blown vessels from this excavation have been published, and they are all Isings Form 50 or 51 bottles (van Lith 2009: 60-61, Nos. 47, 48, and 55). A further four out of the total 20 bottles of this form are also mould-blown but are not included in the catalogue. There are two bottles were found in contexts with material that could be dated to the late-Claudian period, and two fragments that could come from either Form 50 or 51 (a body and handle fragment of different shades of natural coloured glass) fall into a much broader Augustan to Flavian date range (van Lith 2009: 60-61. Nos. 47, 48, and 55).

The beakers are fairly non-descript. One is just a small body fragment with a curvature that indicates that it is close to an everted rim, but that in its self is not enough to clearly define a form. The other is the lower portion an Isings Form 32 beaker with an open ring base. There are no visible indents, but the body is almost square, indicating a variant of this form that is known from earlier excavations at other Roman sites in Nijmegen: notably two examples I the Valkhof Museum collection, which were found in a Roman cemetery (Isings 1957: 46).

4.2.2.1.2 Kops Plateau

Mould-blowing, like other forms of moulded glass, appears to have been more common in the military context at Nijmegen. There are between 16 and 25 mould-blown vessels that can be identified in the assemblage. The vast majority of these, including all nine of the vessels that could either be free-blown or mould-blown, are prismatic or cylindrical storage bottles that were durable and easily transported. The fact that the increased number of mould-blown vessels within the fort is largely determined by a larger number of storage and transport vessels fits the pattern identified by Cool and Baxter (1999: 83), which argues that soldiers had more need of import goods than civilians, to uphold their Roman diet, and to store food.

The only mould-blown vessels that are not for storage purposes are two shallow cups, a colourless beaker, and two fragments whose form cannot be determined. One of the cups has wheel-cut decoration. It appears to match the typically free-blown style of Isings Form 12, despite having a texture that suggests mould-blowing (van Lith 2009: 21 No. 68). The other cup is a dark green, relief-decorated, gladiator cup. The surviving fragments bear the legend 'ORIESC' with further illegible traces on two more fragments. The collection tag and an annual report from the year the vessel was discovered reveals that the currently illegible parts are 'RVD,' and that the full legend was likely ORIESC[ALVMVS] [P]RVD[ES] (Rütti 1988: 8 No. 48f).

The mould-blown beaker comes from a mixed bag of colourless fragments with 57 fragments that are diagnostic or over one centimetre in size. The mould-blown fragments appear to be from an Isings Form 32 beaker. There are a combination of base fragments that are either very slightly concave or even open ring base form but the remains are so fragmentary that it is difficult to determine with absolute certainty. What can be determined is that at least some fragments are mould-blown, and they are too thin to have been used to support a vessel the size of some of the wall fragments that are present and appear to be free-blown. In spite of the lack of detailed vessel information, it is possible to speculate that this beaker was of relatively high value. Aside from being a beaker, which Cool (2006: 78) associates with officers in first-century military bases, it was very fine glass, and it has been intentionally decolourised to give it a high decree of clarity, which was known to increase the value of glass in the fourth century (Diocletian *Price Edict* 16.1-9).

Mould-blown bottles are generally fairly basic and utilitarian in design, but decorated bases including either the maker's mark or simple geometric designs are not uncommon. Five of the 12 clearly mould-blown bottles from the Kops Plateau have base decoration. These base mouldings are all restricted to concentric rings and raised dots.

Although there are only two completely unidentifiable mould-blown vessel fragments, one fragment is worth noting. It comes from a fairly thick-walled vessel, which could suggest identification as a bottle or jar, but no diagnostic features are present. There is clear evidence of a mould including a raised pellet that is indented from the interior, and the texture of a mould. The moulded texture is present on both sides, unlike most mould-blown vessels, which only have mould contact on the exterior and have smooth interior surfaces. There are however, directional bubbles in the glass that encourage a mould-blown production type rather than cast. The most likely reason for the textured interior seems to be heat damage either from use or from the destruction of the fort.

Another unidentified item with very shallow converging ribs on the exterior had a note on its item tag suggesting that it may have been produced in an optic mould. Because optic moulds are not multi-part, they can only produce very shallow decoration like the ones on this fragment, which could allow the vessel to be withdrawn without the mould being taken apart. The shallowness of the ribs also means that they could be produced without creating interior indents. Only the extra glass raised on the outside is provided by variations in the thickness of the walls in this type of mould-blowing.

4.2.2.2 Free-Blown

Free-blowing is the best represented production technique in both Nijmegen sites, making up at least 55.85 per cent of the total glass assemblage or 80.76 per cent of the blown glass from the Kops Plateau fort (Fig. 4.11), and 80.48 per cent of the assemblage or 92.86 per cent of the blown glass from *Oppidum Batavorum* (Fig. 4.12).

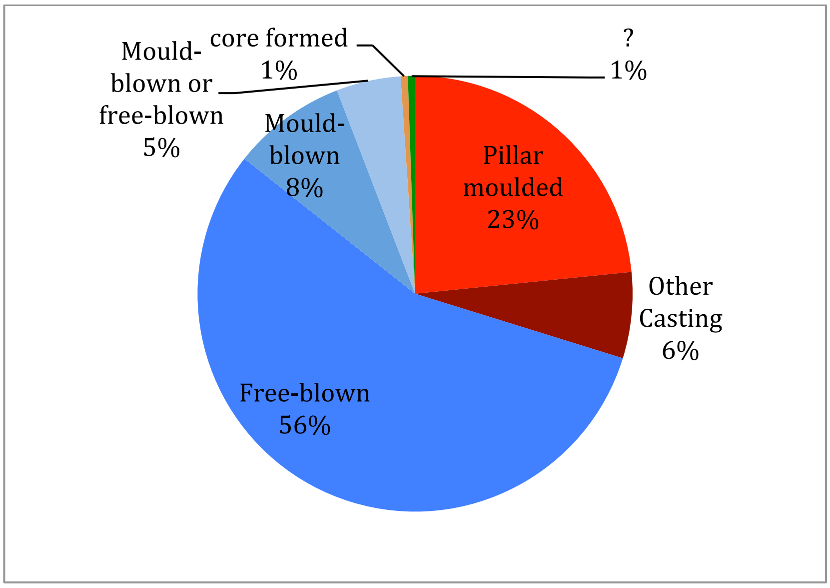


Figure 4.11: Percentages of production types on the Kops Plateau.

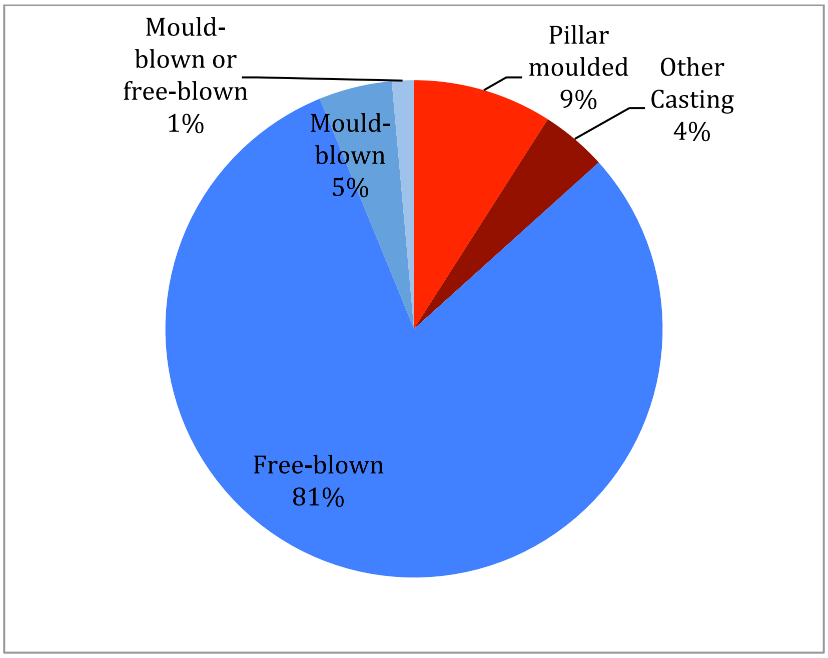


Figure 4.12: Percentages of production types in *Oppidum Batavorum*.

While the types of vessels are not vastly different in the military and civilian contexts, the civilian assemblage does contain a greater variety of free-blown vessel types as well as a greater number and percentage of free-blown vessels (Table 4.3). This may indicate that civilians had more variety in their glass needs due to less regimental lifestyles, but it also reflects the fact that soldiers were using more cast vessels for their eating and drinking needs, so they did not need the same variety of blown vessels.

Table 4.3: Numbers of free-blown vessels from both Nijmegen sites.

Vessel Type	*Oppidum Batavorum*	Kops Plateau
Beakers/Cups	42	32
Beaker, Cup, or Bowl	10	3
Bowls	11	5
Plates	3	0
Plate or Bowl	1	0
Jugs	11	7
Flasks or Jug	4	7
Flasks or Unguentaria	1	0
Unguentaria	17	10
Jar or Jug	5	0
Bottles	12	7
Jar, Flask, or Amphorisk	5	3
Unidentifiable	47	29
Funnel	0	2
Total	**169**	**105**

4.2.2.2.1 Beakers and Cups (Appendix 1.C.1-2)

There are few examples of vessels that can positively be identified as beakers at either Nijmegen site. The Kops Plateau assemblage contained just seven beakers of four different forms and *Oppidum Batavorum* contained only 11 of four different forms, one of which could be considered a small jar with an everted rim rather than a beaker (Table 4.4). The reason for the absence of beakers is unclear, but fragility may play a part, as could Cool's idea that beakers were preferred by officers rather than common soldiers, or the similarly paid auxiliary cavalry who occupied the Kops Plateau fort (Cool 2006: 78; Lendering 2009).

Table 4.4: Beaker forms at Nijmegen.

Isings Form	Kops Plateau	*Oppidum Batavorum*
4	0	1
29	0	1
30	1	0
32	1?	0
34	4	6
Ovoid beaker with everted rim and closed base ring	1	0
Unclear	0	2
Total	**6–7**	**10**

Cups are identifiable in greater numbers than beakers, but in fewer forms. Excepting two unidentifiable cup forms from *Oppidum Batavorum*, one of which could be from a small bowl, all cups from both locations are examples of Isings Form 12 hemispherical cups with wheel cut decoration. A noticeable difference between the assemblages of Isings Form 12 cups from these sites is that the ones at *Oppidum Batavorum* are quite ordinary, where a few of these cups from the Kops Plateau go beyond the simple wheel-cut and abraded decoration and may have held higher status (Table 4.5). Three fragments from trench 299 and one from trench 385 come from a cup made from layered glass. The exterior of the former is a bright, translucent, almost turquoise green and the interior is made of opaque white glass (van Lith 2009: 21, No. 66). The latter vessel has a dark blue exterior and white interior (van Lith 2009: 21, No. 65). Another cup of this form (KH/350/537) has an example of painted yellow blob decoration just below the rim of the dark green vessel. This decorative variant was known in the Augustan-Neronian period, but was rare in Germania inferior. The only known examples come from Nijmegen, Xanten, and Neuss (van Lith 2009: 22, No. 76). The final example with additional decoration came from the same trench as the one with the yellow blob, and has trails of opaque white glass marvered onto the purple surface in a garland pattern (van Lith 2009: 22, No. 75).

Table 4.5: Cup colours at Nijmegen.

Isings Form 12	Site	Blue-green	Light blue	Light green	Yellow-green	Dark Blue	Dark Green	Purple	Brown	Layered
	**Op. Bat.**	11	2	2	1	0	0	0	0	0
(After Isings 1957: 28)	**K-P**	8	2	1	0	1	3	2	1	2-3

Numerous other vessels fall into the category of cups, or beakers but cannot be placed with certainty into either group. There are 11 examples of either cups or beakers from the Kops Plateau, most of which have traces of abraded or wheel cut decoration, which could make them Isings Form 12 cups, or beakers of forms 29, 30, or 34. One is colourless, two are dark blue and three are light green, but the rest are just natural blue green.

The results from *Oppidum Batavorum* are a little more varied (Table 4.6). Some of the vessels may be bowls rather than cups or beakers and they come in at least six different colours. One of the colourless cup or bowl examples has pinched ribs suggesting a potential identification as Isings Form 17 but the fragment was too small to allow confirmation.

Table 4.6: Cups, beakers, or bowls from *Oppidum Batavorum* by colour.

Vessel Type	Blue-green	Yellow-green	Light blue	Dark blue	Dark green	Colourless
Cup or Beaker	5	1	1	2	1	4
Cup, Beaker, or Bowl	6	0	1	2	1	3

4.2.2.2.2 Bowls (Appendix 1.C.3)

There are not many examples of free-blown bowls at either Nijmegen site, but they are particularly sparse at the fort on the Kops Plateau (Table 4.7)where the pillar-moulded bowl is most common. The Kops Plateau assemblage contains a mere seven free-blown bowls, two of which have somewhat questionable identifications, and only one of which can be identified with a specific Isings Form. *Oppidum Batavorum* has only slightly higher numbers with 11 identified bowls of three different identifiable Isings Forms.

Table 4.7: Free-blown bowl forms at each Nijmegen site.

Isings Form	**Kops Plateau**	***Oppidum Batavorum***
17	1	4
42	0	1
44	0	2
Unclear	6	4
Total	**7**	**11**

Colour variation was fairly limited at both sites with the largest number of bowls being a natural blue-green, with lower numbers of light green, light blue (both of these two are still in the range of natural glass colour), dark blue, and purple (Table 4.8). The prominence of natural coloured bowls indicates that they were made for regular use rather than for displays of wealth and status.

Table 4.8: Distribution of free-blown bowls from Nijmegen by colour.

Colours	**Kops Plateau**	***Oppidum Batavorum***
Blue-green	4	7
Light green	0	2
Light blue	0	1
Dark blue	2	1
Purple	1	0

4.2.2.2.3 Plates (Appendix 1.C.4)

The Kops Plateau fort has no evidence for free-blown plates. Plates are present in the *Oppidum Batavorum* assemblage, but in small numbers. Only three free-blown vessel fragments can be identified as plates. Two of these are recorded as plates in van Lith's catalogue (2009: 55-56, Nos. 22-23), although their form – Isings 46 – is better described as a shallow dish that straddles the boundary between a wide shallow bowl and a plate with an up-turned edge. Both of these are a dark blue colour that was popular in the early first century A.D. The third potential plate is a natural blue-green fragment that is almost certainly a plate, but has a slight possibility of being window glass.

4.2.2.2.4 Jugs (Appendix 1.C.5)

Jugs are fairly common among first-century glass assemblages, but are not very common at either the civilian or military settlement at Nijmegen (Table 4.9). Their identification can be controversial without good portions of the vessel, as various features are similar to those on other vessel types. Rim and neck designs are similar to those on bottles and flasks, and body or base fragments can resemble jars, ovoid cups, bowls, or *anforiskoi*. Numerous examples of such confusions appear in van Lith's catalogue of the *Oppidum Batavorum* glass. Van Lith's item 44 is body fragment of an ovoid vessel, which she records as a potential jug, anforisk or jar (van Lith 2009: 59-60), and items 56-58 (van Lith 2009: 61) are base and body fragments belonging to either Isings Form 52 bulbous jugs (Isings 1957: 69-71) or Isings Form 67b/c bulbous or ovoid jars, one of which is a ribbed variety (Isings 1957: 86-88). In total there are 24 potential free-blown jugs from the *Oppidum* and 14 from the Kops Plateau. Of these only nine and seven vessels respectively can be given this identification without hesitation and almost all of these include at least part of an angular strap handle with a prominent central ridge or two, or fragments of a long handle trail that can help with the identification.

Table 4.9: Possible recognisable jug forms from Nijmegen.

Isings Form	Kops Plateau	*Oppidum Batavorum*
52a or 52b	3	4
13 or 53	1	0
14	0	2
14 or 52	1	0
52 or 55a or 55b	2	0
Total	**7**	**6**

4.2.2.2.5 Flasks (Appendix 1.C.6)

There are no clearly identifiable flasks from *Oppidum Batavorum*, and only four from the Kops Plateau fort. Those from the Kops Plateau are all unremarkable natural blue-green examples of Isings Form 16 and none of them even bear the wheel cut decoration that many examples of this form have (van Lith 2009: 24, 27, Nos. 84-87).

4.2.2.2.6 Unguentaria (Appendix 1.C.8)

Unguentaria are quite common among glass finds, possibly because their small curved forms are able to resist breaking, or do not break into as many unrecognisable pieces as a larger vessel might. While they are among the more prominent free-blown vessel types from Nijmegen, and come in a variety of forms (Fig. 4.13), they are not the overwhelmingly dominant type that they are in the prosperous civilian settlement of Herculaneum, with its numerous bathhouses. The disparity in numbers would suggest that unguentaria, or at least the highly durable tubular forms –Isings Form 8 and 27– (Isings 1957: 24, 42) were not used to quite the same extent on the frontier as in the heart of the Empire. This does not mean that unguentaria were not used in at the frontier because Roman bathing practices were still central to their culture and baths have been identified at many Roman sites. Isings mentions examples a number of datable examples of Form 8 unguentaria being found at sites throughout the Rhineland including a Tiberian grave at Kreuznach, Hofheim, Xanten, and the Hunerberg cemetery at Nijmegen (Isings 1957: 24; Hussong 1939: 245; Ritterling 1913: 376; Houben: 1839 pl. IIc; Vermeulen 1932: 159, 166). Isings' only datable examples of Form 27 in the Rhineland come from Cologne and Xanten, but both of her examples post-date the revolt that created the terminus for this study (Isings 1957: 41). Of the potential examples of unguentaria in the assemblages from the Kops Plateau and *Oppidum*

Batavorum, only two and vessels from each site respectively are examples of tubular forms. These come from general unguentaria counts of 19 and 21 vessels. The pyriform forms 6, 26a, and 28 are more prominent at the fort than tubular unguentaria. The fort also yielded one example of a candlestick unguentarium, Isings Form 82a, which is best known from the second to fourth centuries, but occasionally appears in the later half of the first century, usually from the Flavian period onward (van Lith 2009: 32, No. 128: Isings 1957: 97-99). There are fewer additional recognisable forms from the *Oppidum*. One recognisable vessel of each of Isings Form 6 and 26a, and with one additional vessel that could be either an Isings Form 10 globular unguentarium, with virtually no neck (Isings 1957: 25-26), or a very thin walled example of an Isings Form 61 aryballos (Isings 1957: 78-81). The small scar under the edge of the rim is what leads the latter possibility, as this could be the remains of a handle attachment. Van Lith makes no comment on this in her catalogue and leaves it as an unidentified "bath-flask" form (van Lith 2009: 63, No. 61).

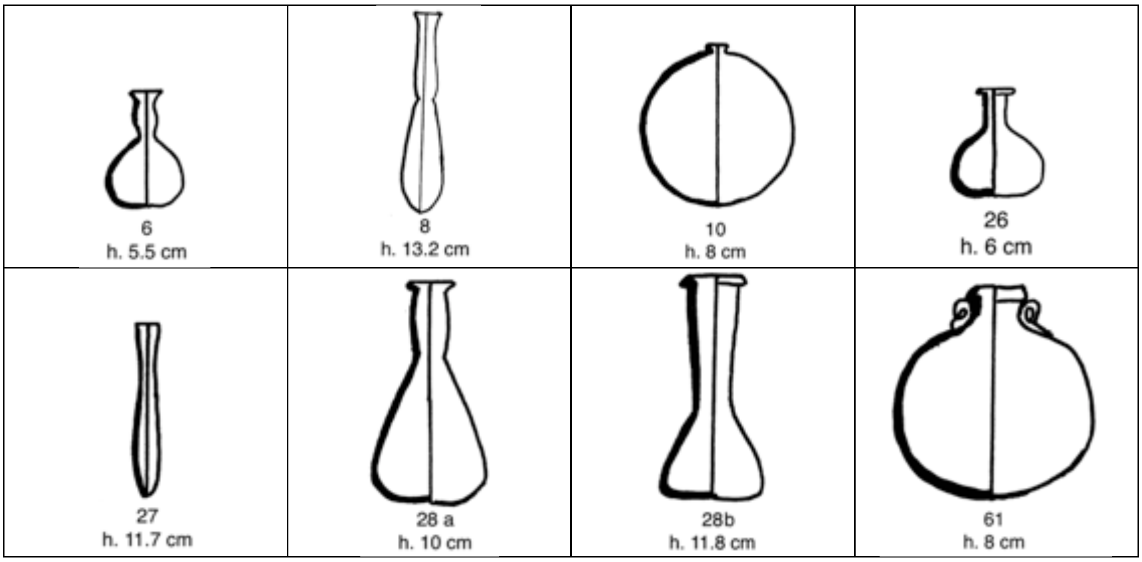


Figure 4.13: Unguentaria forms at Nijmegen (After Isings 1957: 22, 24. 26, 40-43, & 79).

4.2.2.2.7 Jars (Appendix 1.C.10)

Jars are not common items in either Nijmegen assemblage. There is, in fact only one preserved example between the two sites, which can be identified as a jar with complete confidence. It comes from the Kops Plateau, and is a vertical collar rim of an Isings Form 67b/c jar (Isings 1957: 87-88; van Lith 2009: 30, No. 116). The Kops Plateau assemblage has two more potential jars identified by body and base fragments, but one may be a bowl and the other could be a jug or anforisk with an open ring base. Every one of the seven potential jars in the *Oppidum Batavorum* assemblage has controversial identification and has been mentioned in a previous section. Six of them could be Isings Form 67 b or c jars or jugs, and one could potentially be an anforisk. The seventh is a small carinated form with abraded bands around the collar that could just as likely be a carinated beaker along the lines of Isings Form 4, although only having the upper portion preserved it could also match with forms 30-35 or the 36b chalice form (Isings 1957: 21, 45-50).

4.2.2.2.8 Bottles (Appendix 1.C.11)

Many of the bottles of Isings Forms 50 and 51 found at Nijmegen appear to have been free-blown. This is surprising given that mould-blowing was very common for utilitarian bottles and helped create uniform sizes that were easy to pack for shipping and storage. Where there were only eight certain examples of mould-blown bottles at *Oppidum Batavorum*, while 12 examples appear to have been blown with no evidence of a mould. Three additional free-blown examples could be bottles or flasks or jugs. The problem with these identifications is that almost all of them are neck, rim, and handle fragments meaning that excepting one instance where a body fragment clearly comes from a Form 50 bottle, it is impossible to determine which of these two forms the fragment comes from, and the parts that would have been in contact with a mould are absent. As a result the vessels must be described in this section rather than the mould-blowing section (Isings 1957: 63-69; van Lith 2006: 26-30; Price 1995; 185).

The bottles from the Kops Plateau are less problematic, and the vessel numbers are more in line with expectations. There were 12 examples of mould-blown Form 50 bottles mentioned above, and there is evidence of only seven free-blown bottles. Of these, three are clearly cylindrical bottles, which were often free-blown, and only two are positively identified as square bottles that had been marvered to have flat sides. The remaining two are identified by a rim and handle, which could come from either form and cannot be used to determine which form of glassblowing created the vessel (van Lith 2009: 30, Nos. 111, 115).

There is no apparent pattern determining who used these bottles within each site, but they represent a significantly lower percentage of the assemblage in *Oppidum Batavorum* than on the Kops Plateau. In *Oppidum Batavorum* the bottles make up just under seven per cent of the assemblage compared to 14.36 per cent of the assemblage on the Kops Plateau. These percentages fall into line with Cool and Baxter's (1999: 83) idea that the military made greater use of bottles than civilians.

4.2.2.2.9 Unidentifiable

Owing to the highly fragmentary nature of these assemblages there are numerous free-blown fragments that cannot be identified as any specific vessel type. There are at least 16 completely unidentifiable unique vessels among the glass items from the Kops Plateau fort and a minimum of 43 from the civilian settlement of *Oppidum Batavorum* on St. Joseph's Hill. These fragments are mostly body fragments, with the occasional small bit of rim or base, and they come in the full range of colours of vessels from the sites. There is very little that can be determined from these vessel fragments other than forming a more complete image of the minimum number of vessels in each production type. Eight of these vessels from the Kops Plateau, and 14 from *Oppidum Batavorum* are at least identifiable as probable tableware or toilet items due to the thickness and shape of the wall fragments.

4.3 Patterns

Both of these Nijmegen assemblages indicate that glassblowing was responsible for the majority of vessels, and the majority of forms in frontier sites of the first century A.D., as cast forms are less variable and frequently harder to produce, but that glassblowing had not made casting techniques entirely obsolete. In fact, the Isings Form 3 bowl form, which is cast, is the most prominent individual form at both sites.

Of the total 188 vessels from the Kops Plateau more than 69 per cent are blown forms. By contrast, over 86 per cent of the 210 vessels from *Oppidum Batavorum* were blown. The difference is largely filled by the increased prominence of the pillar-moulded bowl, which was shown above to be more prominent in the fort than the *Oppidum* (Tables 4.1 and 4.2), but other cast forms were also better represented. Cast forms represent more than double the proportion of vessels in the military assemblage than they do in the civilian assemblage. The precise reasons for this are unclear, but one possible suggestion is that cast vessels were more durable than blown vessels. Examination of fragments determined that the walls of cast vessels were frequently around twice as thick as those of equivalent blown vessels (Appendix 3: column K). As a result, soldiers, who would have been required to move their goods over long distances for their different postings, might have preferred cast vessels. Hanel (1995a) noticed this trend among soldiers when commenting on Isings Form 3 bowls from Xanten, Germany as is discussed in the following chapter.

The majority of blown vessels appear to be ordinary utilitarian vessels, with only a handful of exceptions. Since both sites were destroyed violently at the end of the Batavian revolt, there is a strong possibility that any decorative blown vessels that may have been present could have been too badly broken to be found, due to their delicate, thin walls. The same fragility could also have made fine, free-blown glass uncommon in the fort, as military units that move around regularly might have preferred more durable vessel designs such as the pillar-moulded bowl or ceramics.

Table 4.10: Vessel numbers and percentage of assemblage represented by each production type at the Kops Plateau fort.

Production Category Kops Hof	Technique	MNI vessels	Percentage of Total Glass
Casting	Pillar-Moulded	44	23.4
	Other Casting	12	6.38
	Core Formed	1	0.53
	Total Cast Glass	57	30.32
Blowing	Free-blown	105	55.85
	Mould-blown	16	8.51
	Mould-blown or free-blown	9	4.79
	Total Blown	130	69.15
	Uncertain Method	1	0.53
Total Vessels	All methods	188	100

Table 4.11: Vessel numbers and percentage of assemblage represented by each production type at *Oppidum Batavorum*.

Production Category	Technique	MNI vessels	Percentage of Total Glass
Casting	Pillar-Moulded	19	9.05
	Other Casting	9	4.29
	Total Cast Glass	28	13.33
Blowing	Free-blown	169	80.48
	Mould-blown	10	4.76
	Mould-blown or free-blown	3	1.43
	Total Blown	182	86.67
Total Vessels	All methods	210	100

The ratio of cast to blown vessels from these sites illustrates one noticeable difference. The fort on the Kops Plateau contains a substantially higher percentage of cast vessels than the civilian settlement (Tables 4.10 and 4.11). The majority of this difference is made up by the numbers of Isings Form 3 pillar-moulded bowls, which were found in contexts spread across the fort excavation with no distinct pattern of decorative vessel use. The building identified as the *Principia* had only two vessels of this type found in its ruins, and only two of the eight pillar moulded bowls found close to, or in the *Praetorium* were mosaic bowls. The pillar-moulded bowl made up nearly a quarter of the fort's assemblage, and 77.19 per cent of all the cast glass. By comparison, less than 10 per cent of the glass vessels from *Oppidum Batavorum* were pillar-moulded, although this form still made up over 70 per cent of the cast glass.

Mould-blowing was poorly represented at Nijmegen, making up less than 10 per cent of each assemblage's vessels, and most mould-blown vessels are primarily utilitarian. Only a handful of beakers show evidence of mould-blown decoration, and only a few fragments of a green gladiator cup show evidence of a highly decorated item. The remainder of the mould-blown vessels are simple Isings Form 50 and 51 bottles. These may be under-represented[59] due to the presence of vessels only identified by rim, neck and handle fragments, but even if all of the bottles are mould-blown the production type would still be a minority at Nijmegen.

The majority of glass forms from the Kops Plateau represent tableware, either for serving or for eating and drinking, and the remainder of the identifiable vessels are fairly evenly distributed between storage vessels. Among the vessels of this assemblage 117-123 of the total 188 vessels (62-65 %) can be considered to be tableware, 29 or 30 (15-16 %) vessels are storage containers, and 23-27 (12-14 %) are toilet vessels.

The numbers at *Oppidum Batavorum* are less clear because of the number of fragmentary vessels that could represent one of a number of different forms. The

[59] According to Isings argument (Isings 1957: 63-64), most of the type 50 bottles were likely mould-blown, but without evidence they cannot be assigned to this category.

potential glass tableware items could number anywhere between 126 and 144 out of the total 210 vessels, or 60-69 per cent of the assemblage. This tally is less precise than that of the Kops Plateau tableware, but the proportion of tableware vessels is similar. Storage wares could be represented by between 19 and 32 vessels (9-15 %), and 17-22 (8-10 %) vessels are toilet items. Both of these categories fall slightly lower than the Kops Plateau numbers, but are close enough in line to suggest that percentages of each category of vessel used were fairly similar.

In addition to the noted prominence of the Isings Form 3 bowls there was another tableware form that was readily recognisable at both sites. The small hemispherical 'Hofheim' cup form (Isings 1957: 27-30, Form 12), which frequently had horizontal wheel cut line or abraded band decoration, was one of the most identified forms. It must be noted, however, that its fragments can be confused with those of beakers of Isings Forms 29, 30, and 34. This similarity could mean that the form is over-represented, but this might be countered by the fact that small wall fragments without decoration could easily fall into the unidentifiable category, subtracting vessels from the tally of Hofheim cups. There are 16 positively identified examples of this form from the *Oppidum Batavorum* site (Fig. 4.14), making up 7 per cent of the whole assemblage. At the Kops Plateau, there are 20 certain identifications of this form (Fig. 4.15), and the number could reach 25 vessels if the fragments that could not be distinguished from incised beakers are, in fact, Hofheim cups. That means that, in the military context, this form represents between 10.6 and 13.3 per cent of the assemblage. These numbers suggest that this could have been one of the most popular vessel forms at Nijmegen in this period. It makes up a significant percentage of each assemblage, and its use may follow a similar pattern to the popular pillar-moulded bowl. Just as with pillar-moulded bowl percentages, the percentage of the assemblages represented by

Isings Form 12 cups doubled from the civilian to the military site. The numbers of Form 12 cups are lower, but that might be expected as it has thinner walls and may more easily be broken beyond recovery and recognition. The correlation of percentages may, however indicate that these two types of vessels may have been used for similar purposes or in the same kinds of situation.

4.4 Distribution

While there are good records for the trench numbers in which glass vessel fragments were found, and the location of those trenches within the excavation areas, the absence of identified buildings and feature types, which were not available at the time of study, severely limits the potential for distribution studies. It is, in most cases, impossible to identify the social levels with which glass fragments were associated, but it is possible to look at the overall prominence and scatter of glass across the sites to make some inferences into the spread of glass use.

The excavations of the two Nijmegen sites in this chapter were of substantially different sizes, and the density of vessel glass finds varied greatly. The assemblage from the civilian settlement had 210 individual vessels found in an area of only 7000 metres squared (van Lith 2009: 48). This produces a find density of 0.03 vessels per metre squared, which is six times the find density of glass finds on the Kops Plateau. The 188 vessels gleaned from an excavation area of approximately 37,500 metres squared, on the Kops Plateau, only equalled 0.005 vessels per metre squared (van Lith 2009:8).

Many of the well-documented forms at the Nijmegen sites show broad distribution patterns that illustrate affordability and common status. Figures 4.6 and 4.8 show the spread of pillar-moulded bowls remains across most of the territory of both excavations. There are apparent concentrations around some high-status buildings in the fort, and in two unidentified buildings of the civilian settlement, but there is no indication that people from a broad range of contexts could not afford the forms. Certain concentrations, in conjunction with the wide spread in different contexts, may simply indicate that wealthier individuals could afford more vessels, not that the vessels themselves were of a status only affordable to the wealthy. The pillar-moulded bowl distribution is key for understanding the role and status of cast glass in relation to blown glass because it shows that cast forms are not necessarily restricted to certain areas or social contexts. A wide distribution pattern, such as those seen in *Oppidum Batavorum*, and especially on the Kops Plateau and suggest that cast glass could be found across the wide areas that include spaces, which could span numerous social and wealth levels. If cast vessels were costly and rare, distribution patterns would likely indicate that the majority of use was centred on the high-status structures typically located at the centre of Roman military sites, but the pillar-moulded bowl distribution in the Kops Plateau fort extends across the majority of the site.

Isings Form 12 ‘Hofheim’ cups, the most common blown form at Nijmegen, and the similarly decorated Form 34 beakers show wide distribution patterns, very similar to those of pillar-moulded bowls. The similarity of distribution between a common, utilitarian, blown form, such as Isings Form 12, and a cast vessel form indicates that they likely had similar broad usage patterns and that, rather than being luxurious, certain cast forms had similar status to ordinary blown vessels. Forms 12 and 34 cluster in the same areas at *Oppidum Batavorum* (Fig. 4.14), but the beakers appear in much smaller numbers than the smaller cups. Fragility may be a key factor, since the beakers had taller walls and, therefore, more surface area to break, or this could be an indication of drinking patterns, showing a strong preference for the smaller cup form. Form 34 beakers are also found alongside Form 12 cups, and in a similar distribution range to the cups, in the Kops Plateau fort, but the cups found in far greater numbers and in more contexts (Fig. 4.15).

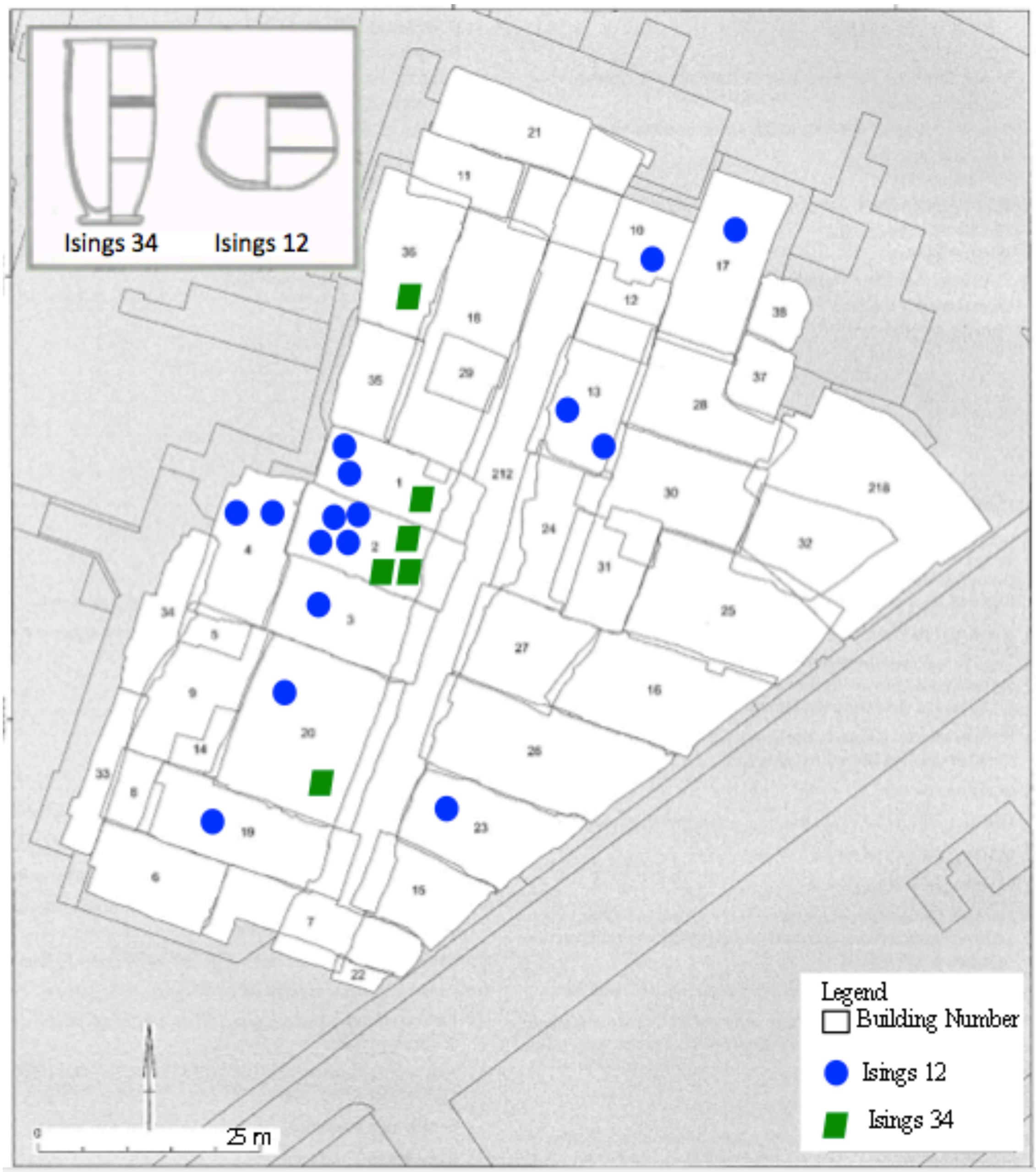


Figure 4.14: Find locations of Isings Forms 12 and 34 at *Oppidum Batavorum* (After van Lith 2009: 65).

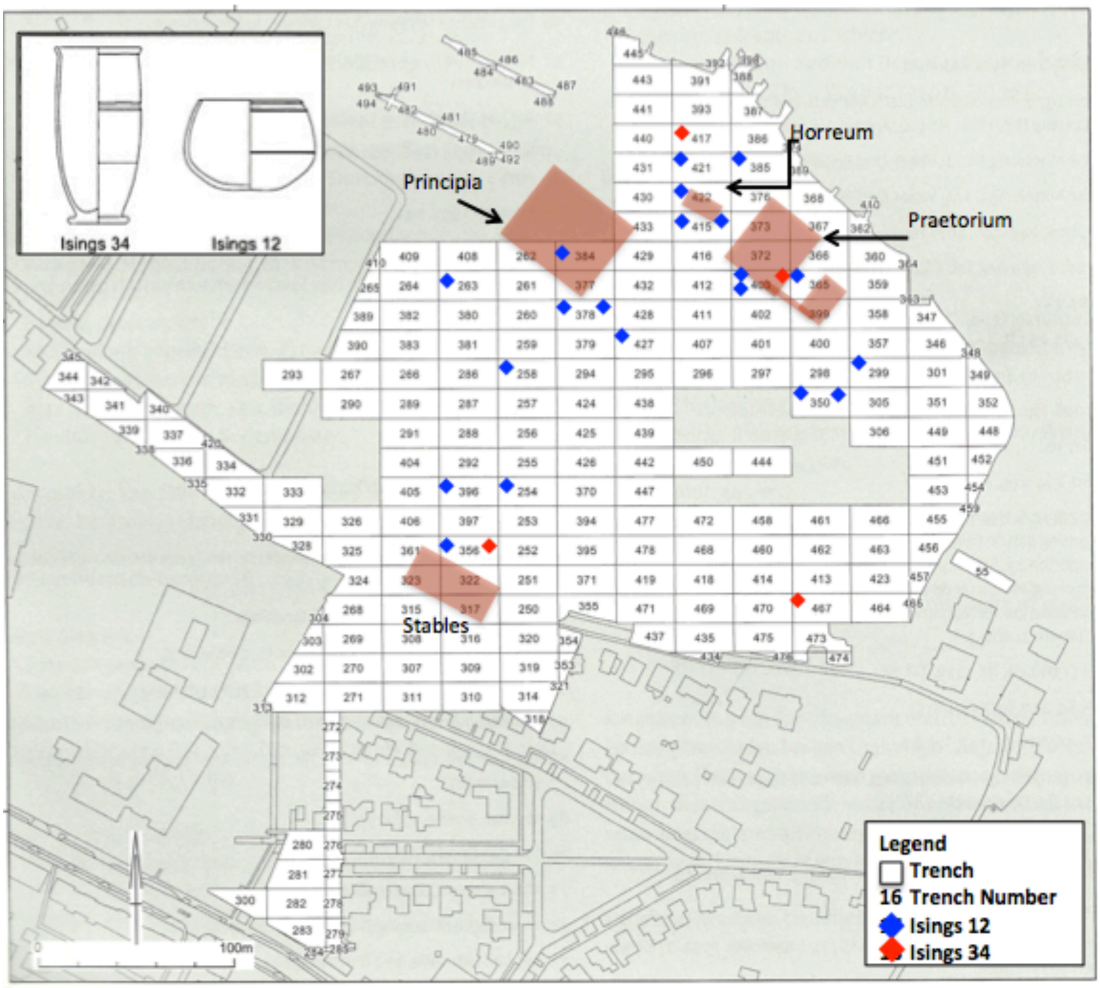


Figure 4.15: Find locations of Isings Forms 12 and 34 on the Kops Plateau (Compilation of two different maps with added labels from van Lith 2009: 9 and 42).

The Isings Form 50 and 51 bottles at the Kops Plateau fort were scattered fairly loosely across the fort illustrating no particular pattern (Fig. 4.16). They would have been durable and easily packed in crates to transport and store liquids, making them valuable to mobile military units. The *Oppidum Batavorum* distribution is also scattered across the site leaving no indication that these bottles were unavailable (Fig. 4.17).

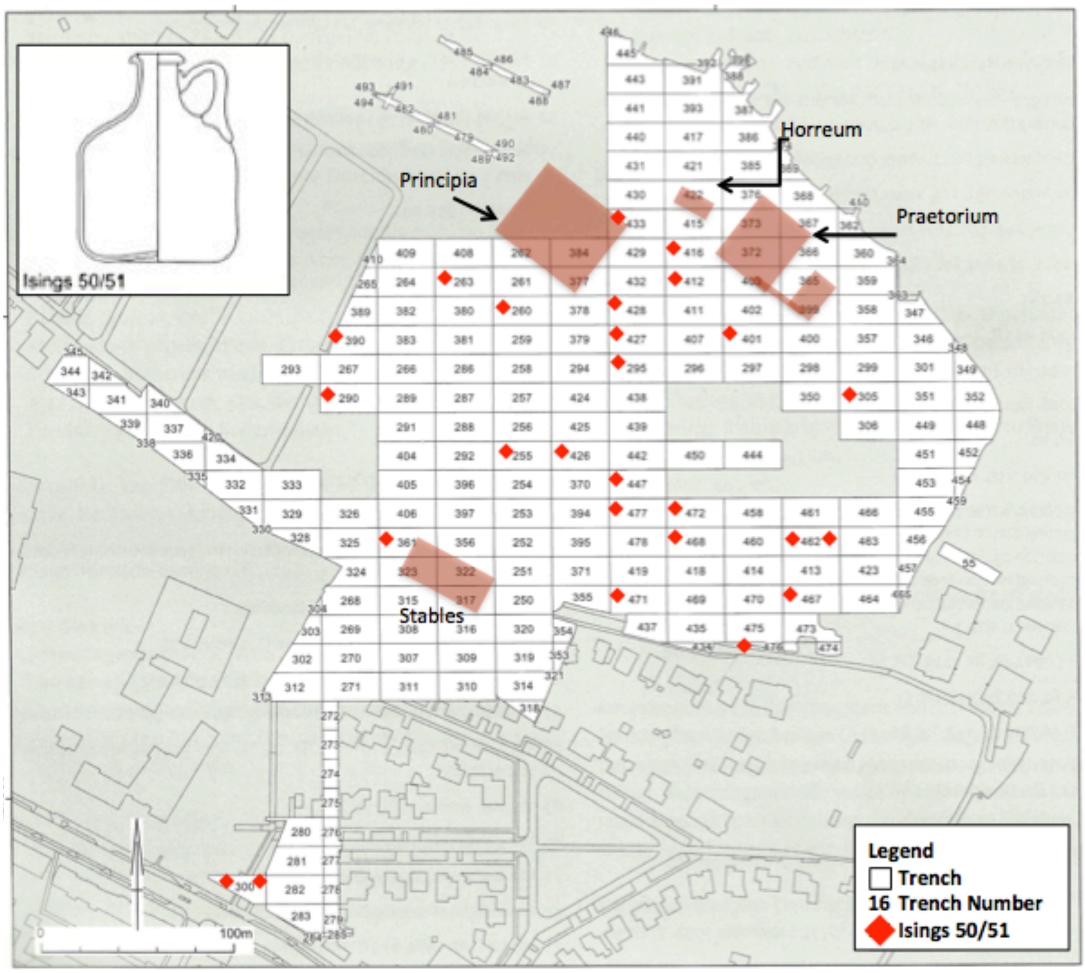


Figure 4.16: Find locations of Isings Forms 50 and 51 on the Kops Plateau (trench 234 not labelled) (Compilation of two different maps with added labels from van Lith 2009: 9 and 43).

Figure 4.17: Find locations of Isings Forms 50 and 51 at *Oppidum Batavorum* (After van Lith 2009: 65)

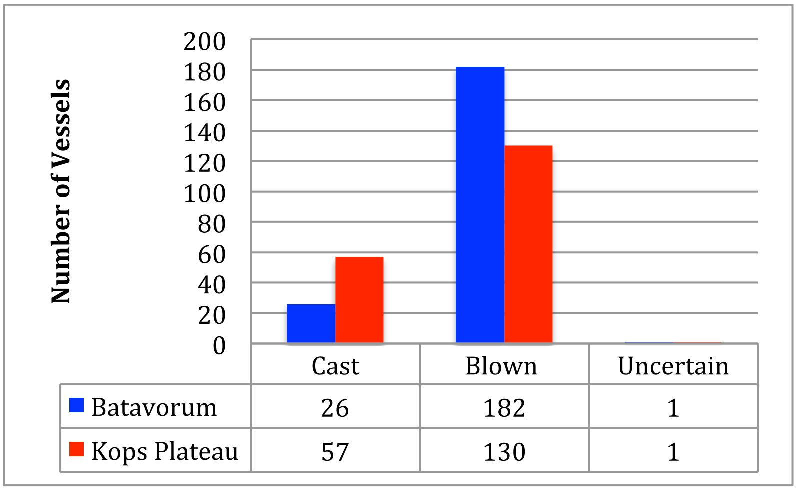
4.5 Conclusion: Contextualising the Data.

The data shows that glass was fairly common in numerous different contexts throughout the Nijmegen sites, and was a widely used material rather than a luxury. The results shows that blown glass made up the majority of vessel glass, but cast glass appears in significant numbers, and there is no evidence that it was used for more expensive or more luxurious vessels. There are no vessel forms from either site that are unique to these sites or unexpected in settlements of mid-first century, but the numbers look quite different between the two site types.

The density of glass vessel finds in the small civilian excavation suggests that civilians may have been making heavier use of glass than soldiers. Furthermore, the significantly higher percentage of blown glass among this assemblage indicates that civilians than adopted the new technology more whole-heartedly than the military, who may have preferred the well-known, durable, cast forms that were becoming popular just before, or around the time of the invention of glassblowing. Whilst no direct evidence has appeared for the local production of glass, the discrepancy in use of different types between the two contexts could indicate that any production centres in the vicinity focused on the new glassblowing technology, brought by the Roman conquerors and camp followers to this region where glass vessel production had not existed prior to their arrival. The fact that cast vessels were fairly common in the military fort suggests that soldiers came from regions that had used both glass production techniques, and may have brought glass of both cast and blown forms with them when they came to the lower Rhineland.

These are just two example assemblages from one location on the edge of the Empire, but if compared to other sites such as the legionary fortress at Xanten they can be judged for how indicative they are of their social contexts, and can be used for judging the spread of production and glass usage to the edges of the Empire. Glass was being used much more widely than it would be if it were in fact a luxury item, although it is not so widely used as to suggest that it was in any way replacing ceramics. There are nowhere near enough examples of glass vessels for all members of the population of each site to have used glass vessels in greater numbers than ceramic vessels, let alone used glass exclusively.

The ratios of glass production types show that glassblowing was the most common method at both sites (Fig 4.18), but that it was not as dominant as might have been expected if glassblowing was responsible for making glass affordable to the general population. The difference between cast and blown glass at *Oppidum Batavorum* was about 74 percentage points, where there was only gap of 40 percentage points at the fort. The largest part of the difference is due to the presence of slumped bowls such as the pillar-moulded form, which were apparently cheap enough and readily available enough to be popular among soldiers suggesting that some pre-glassblowing forms may already have made glass widely available and affordable.



	Cast	Blown	Uncertain
Batavorum	26	182	1
Kops Plateau	57	130	1

Figure 4.18: Distribution of vessels by production category at Nijmegen.

Chapter 5 : Xanten Vetera I: First Century Frontier Fortress in the Rhineland.

5.1 Intro: The Site

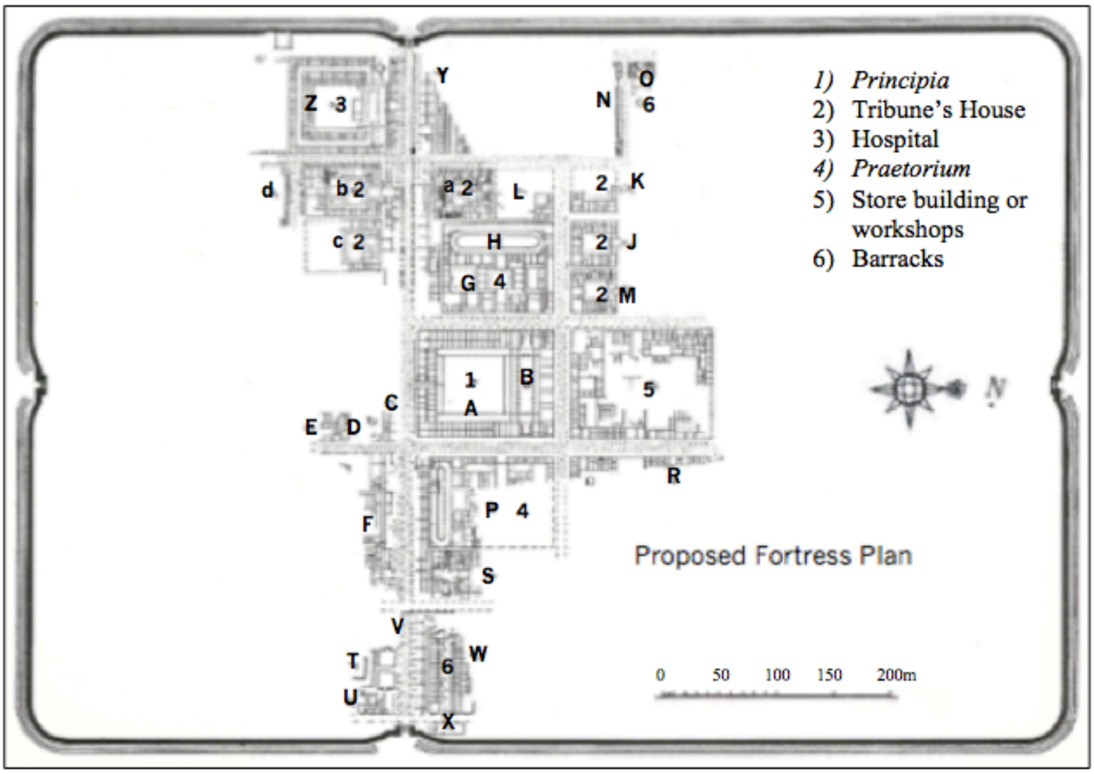


Figure 5.1: Excavation area and proposed fortress area at Xanten, Vetera I (After Allison 2013: 111, fig. 6.2; Hanel 1995 a: Table 169; Johnson 1983: 246).

'Vetera I' is the designation given to the initial site of the Roman legionary fortress *Castra Vetera* (Fig. 5.1), on the *Fürstenberg* (Prince's hill) (Koschik 1995: xi), next to the modern town of Xanten, Germany. It is strategically situated, just under 100 kilometres north-west of Köln (von Elbe 1995: map inside front cover), along the Rhine, which was the most significant first-century trading route into the north-western frontier region (Fig. 5.2) (Fulford 1992: 298), just below the point where the river bends westward toward the sea, and where the navigable river Lippe joins the Rhine.

Figure 5.2: Major trade routes in the first century A.D. (After Fulford 1992: Fig 2)

Castra Vetera was part of a chain of forts and settlements that protected the frontier between the Roman territories of *Germania Inferior* and *Germania Superior*, and the ‘barbarian’ territory of *Magna Germania*. This chain of defences stretched from *Moguntiacum* (Mainz) to *Lugdunum Batavorum* (Katwijk) and Valkenburg at the mouth of the Rhine. The frontier was most heavily fortified from Bonn to Valkenburg (Figure 5.3). Vetera I was one of the largest fortresses in this chain of defences, covering roughly 58 hectares and being capable of housing two legions at a time (Allison 2013: 59; Koschik 1995: xi; von Elbe 1995: 158). The frontier was fortified more sparsely further south in *Germania Superior*, where the concentration of Gaulish and Germanic tribes was lower, by the fortresses at *Argentoratum* (Strasbourg), *Vindonissa*

(Windisch), and the city of *Augusta Vindelicorum* (Augsburg), with two smaller forts in between.

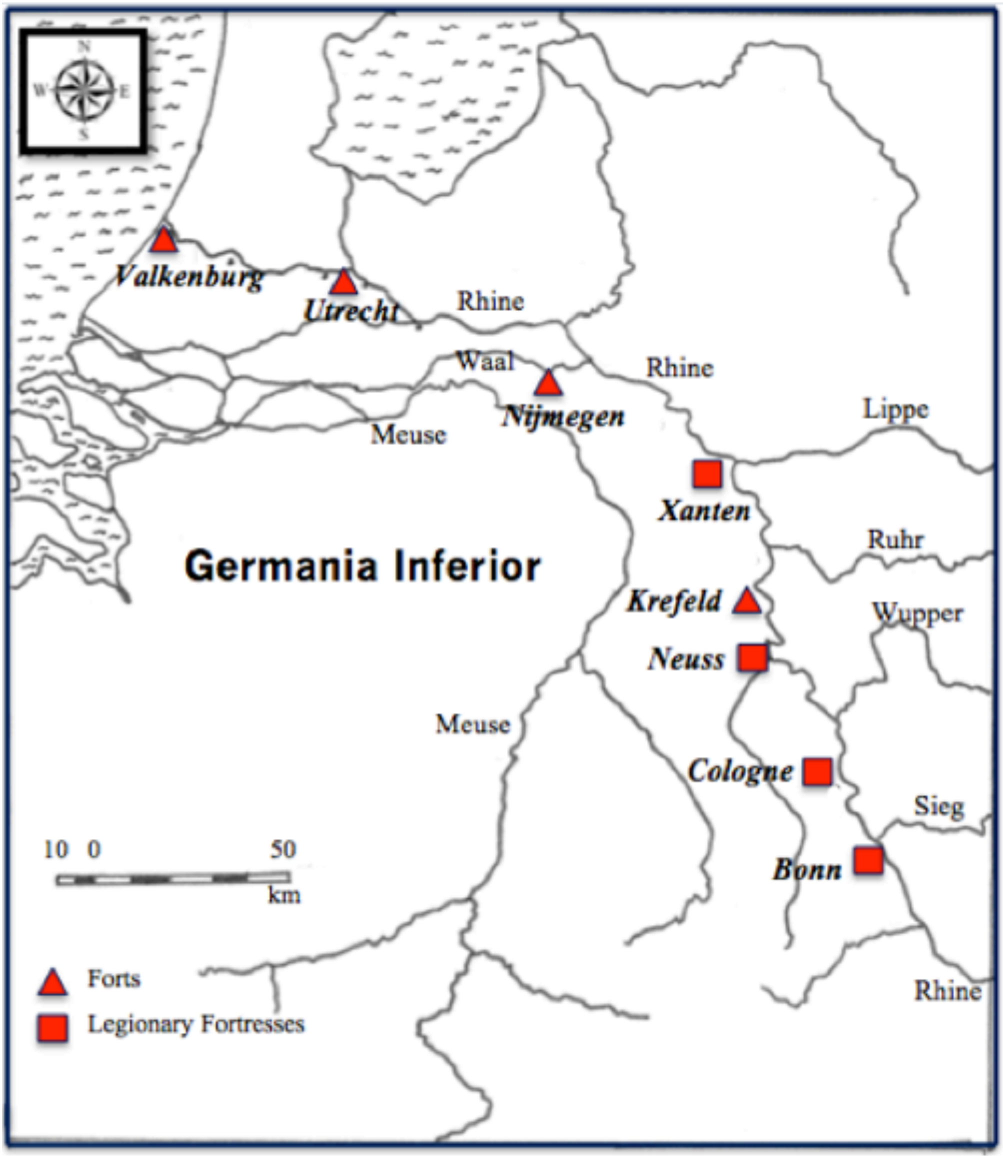


Figure 5.3: Roman fortifications in *Germania Inferior* in A.D. 69-70 (After Johnson 1983: 262; Lendering and Bosman 2012: 96).

Vetera I was the original seat of the governor of *Germania Inferior* and became one of the most historically significant of all the forts along the Rhine. It factored in several military campaigns and uprisings, which feature prominently in Tacitus' *Histories* Book 4 and *Annals* Book 1 (Hanel 1995 a: 1-3). Due to easy boat access into the eastern Rhineland along the Lippe, Vetera I was used as a base of operations for monitoring the Germanic tribes in the area, and as a supply depot for expeditions on the right bank of the Rhine until the Roman authorities decided to consolidate forces on the left bank, following the A.D. 9 defeat of Varus in the Teutoburg Forest (Hanel 1995 a: 3; Sommer 1999: 61).

The location was not only key for pacifying the region, but for establishing control of, and access to, trade routes. The Augustan campaigns that led to the founding of Roman camps in the Rhineland began the first large-scale flow of Mediterranean goods to the region in support of the garrisons (Middleton 1983; Middleton 1979; Whittaker 1989: 53-77), and this expanded into trade with the locals and an increasing civil demand rather than just military demand (Brogan 1936: 195; Fulford 1992: 296). The Lippe river, has been shown, through archaeological finds, to have been a significant point of entry for Roman goods into non-Roman Germany. Large numbers of Roman coins were found at sites along the river, suggesting that trade was not a one-way street, and that Romans were paying for German goods and/or mercenaries from outside the Empire[60] (Brogan 1936: 196-197).

5.1.1 Period of Occupation

The first Roman fortifications at Xanten, Vetera I were established on the orders of Drusus, the stepson of the emperor Augustus, *circa* 13/12 B.C. as Augustus extended the frontier established by Julius Caesar, between 58 and 50 B.C., into the northern Gaul towards the northern Rhineland (King 1990: 42; Lendering 2003). The fortress grew to become a double legionary camp capable of housing 10,000 men, and primarily housed the fifth legion *Alaudae* and the fifteenth legion *Primigenia* (Johnson 1983: 246; Hanel 1995 a: 6; Lehner 1912a: 311; Lendering 2003 Castra Vetera; Tac.*hist*.4, 22.3). While Xanten continued to have Roman occupation until the fifth century, the Vetera I

[60] The Germans have been shown to have imported Roman statuary, spoons, mirrors, jewellery, hairpins, arms and tools, silver drinking cups pottery, glass, and wine in exchange for things like amber (Brogan 1936: 207, 210 and 212-214).

fortress was destroyed during the revolt by the local Batavi tribe in A.D. 69-70. Batavian prince, and former ally of Rome, by the name of Julius Civilis along with the Batavian cavalry, had served as Roman auxiliaries, and had supported Vitellius in his bid to become Emperor,[61] but had twice been accused of plotting rebellion (Lendering 2012: 2). After the defeat of Vitellius, the Batavi rose up against the legions that had sworn allegiance to Vespasian, leading to the destruction of Vetera I, along with Nijmegen, providing the sealed contexts that are key to this study.[62]

5.1.2 Significance of Vetera I to this Thesis

The Augustan to early-Flavian dating of the fort places it at a key time for examining the presence of glass on the Empire's northern frontier. The Batavian revolt destruction layer, at Vetera I, provides a good *terminus ante quem* for the glass material examined, enabling it to be confidently dated to the time period relevant to this study. Accurate dating is further helped by construction of the fortress on a virgin site, and the fact that there was no subsequent Roman construction on top of it. The fortress that replaced it was constructed across a bend in the river to the East, and the second century settlement, which grew into *Colonia Ulpia Traiana* and then into the medieval, and modern town was established roughly one kilometre to the northwest in A.D. 100. This was constructed on the site of *Municipium Cugernorum*, a town, occupied by the Cugerni tribe, with roots that may date as far back as the fourth century B.C. (Allison 2013: 109; Lendering 2003; Müller *et* al: 2008; von Elbe 1995: 157).

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[61] The *Batavi* had provided a unit of personal cavalry to Emperor Nero, which was dismissed by Galba, and provided 8 cohorts to Vitellius when he marched to Italy to secure his claim as Emperor in A.D. 69 (Hanel 1995 a: 6; Lendering 2012: 1).

[62] Civilis initially tried to win over the Vetera I garrison with diplomacy, then several failed attempts at direct assault and finally with a protracted siege. After a further auxiliary defection prevented food supplies from reaching Xanten along the river, the garrison agreed to surrender in return for safe passage away from the fort without weapons. The Germanic forces broke this and ambushed the Roman troops as they left, burning part of the fortress in the process. The fortress was completely razed during the Roman counter-offensive when Civilis attempted to shelter within its walls (Hanel 1995 a: 5-7; *Tac. Hist.* 5.14.1.).

The Vetera I assemblage illustrates the use of glass in a military camp, which was a prominent Roman context type throughout the Rhineland. Roman legionary fortresses were remarkably uniform, so individual sites may be considered as examples of the site type. The appropriateness of this role may be evaluated by comparing its glass assemblage to other Rhineland fortresses, and the military site at Nijmegen, from the previous chapter. Most of these comparisons are, however, limited due to the low number of sites that are as ideal for study as Vetera I, and the lack of personal access to other collections, but similar patterns are visible. Similarities between Xanten and other sites that show Vetera I glass use to be similar to that of other military sites in the region allow the site to be considered representative of a type of Roman frontier settlement, and thus allow for confident use of the Xanten assemblage to look for the differences and similarities between glass use at fortresses and in the other contexts covered in this thesis.

Hans Lehner excavated Vetera I in the early 20th century, using a series of long one-metre wide trenches, which focused on identifying the fortifications and key structures of the final phase of the fortress (Allison 2013: 59, 113). Lehner's excavations were meticulous in recording stratigraphy and features, identifying two earlier Augustan and Tiberian fortifications, the latter of which had a levelling, or burning layer from the 20s or 30s A.D. Lehner's record allows for some find patterns to be traced through time on the site, but the recording of finds within these detailed stratigraphic layers did not have the same level of precision. As a result, objects can be traced to their trench and layer, but not always to the specific building, within the length of the trench, with which the item was associated (Allison 2013: 115). As a result, one cannot perform detailed mapping of find-spots, and while the glass finds can sometimes be dated or assigned to an area of the fortress, it is often unclear whether the objects are in loss contexts, either within the buildings where they were used or on the streets, or if they were in refuse disposal contexts.

5.1.3 Criteria Examined

There has been a substantial amount of study on Roman glass from Xanten, but the majority of the work has focused on the second-century material from *Colonia Ulpia Traiana*. Only a few publications discuss the Vetera I glass, and are not comprehensive studies of consumption or status. Lehner and Hagen included some of the glass in their publication notes in the 1912 *Bonner Jahrbücher*, but they were primarily focused on excavation results and datable material (Hagen 1912a; Hagen 1912b; Lehner 1912a; Lehner 1912b). Lehner wrote a small piece on two glass drinking vessels (Lehner 1912b), but this work is not the kind of comprehensive study that could help to illustrate the social role of glass at the site. Dorothy Charlesworth (1984: 283-297) published a fuller summary of the glass, which highlights most of the vessel types present and catalogues a number of examples of each. This is, however, far from being a comprehensive catalogue or a usage study. It simply highlights the Vetera I assemblage as a point of interest for further study. The most extensive catalogue is Hanel's nearly exhaustive documentation of the pottery and small finds from Vetera I (Hanel 1995a; 1995b). This work catalogues nearly all of the glass fragments from Vetera I, and Hanel arranges them by vessel form wherever he could. He also discusses the glass in a relatively detailed manner, highlighting any information that was known about trade patterns or distributions of forms, and providing a start on the use of glass within the site.

The material studied for this chapter was exclusively that from Vetera I, as there was not a distinct collection of glass from the contemporary *vicus,* which sat partially on the site of the second-century *colonia*. This overlap would have led to a substantial mixing of remains from both occupation periods, and it was not possible to go through the whole Xanten collection to sort out the appropriate material. Due to the nature of Lehner's excavations it will be possible to conduct some broad discussion of the distribution of glass on the site, and to discuss the use of a few forms over time, but the primary focus will still be on the glass fragments themselves and the patterns relating cast to blown material, and then glass to ceramics. Status will be determined primarily by form, decoration, colour and quantity, only utilising context where evidence is clearly provided in publications.

5.1.4 Methodology

The glass from Vetera I was examined, for this study, in the storage facility of the Rheinisches Ländesmuseum, Bonn. The catalogue produced by Dr. Norbert Hanel (1995 b) served as a starting point for this study, allowing for a good idea of the range of material before visiting the collection, and providing an overview of missing fragments. Hanel's catalogue includes all known missing fragments that had been recorded in the earliest excavation reports, and in the *Bonner Jahrbüchen* from the years following the excavations. At least 79 of the entries are missing as a result of the collection's long post-excavation history, [63] and thanks to Hanel they can still be considered here in a limited capacity. All the existing items catalogued were examined, measured, and recorded. The data collected has been filtered to allow vessel numbers to be calculated, and patterns to be examined. Several discrepancies have emerged between my examination and the calculations made by Hanel. Many of these differences occur in the catalogue numbers that Hanel had left as unidentified. A

[63] Some fragments have likely been mislabelled or misplaced in storage and in transportation between the old and new Rheinisches Ländesmuseum buildings, and the storage facility in Mechenheim. It has also been noted that some items were destroyed during the Second World War, when Bonn was bombed and the museum suffered a direct hit (Isings 1957: v).

number of them were, in fact, identifiable, at least to the level of the type of vessel, if not specific form.

5.2 Types of Glass Production

The Vetera I assemblage reveals a range of production techniques ranging from one possible core-formed vessel, to highly decorative, intricate mould-blowing. While there is a wide variety of blown glass, cast glass makes up over a quarter of the glass from Vetera I. This number could be slightly higher, as two per cent of the glass was unidentifiable, mostly because those fragments are missing. It is notable that, while pottery definitely holds the dominant position in the Vetera I soldiers' daily usage, the glass vessel forms are not greatly divergent. Although Hanel describes the glass vessels as having special value as luxury versions of ceramic forms – he suggests that at least 455[64] of the glass vessels found followed basic forms of ceramics – many of them are simple utilitarian forms. He argues that the use of different colours and patterns for the same basic forms created variety and suggested class (Hanel 1995 a: 240).

The close study of the material undertaken for this thesis found that the minimum number of vessels varies significantly from Hanel's estimate. After breaking the assemblage down by vessel type, form, colour, and decoration, the present author looked for any fragments that had find contexts and were sizes that could allow them to have come from the same vessel, and came up with a final MNI tally of 314 distinct vessels. This number does take into account the fact that it was frequently impossible to

[64] The numbers provided here by Hanel are questionable, as his catalogue only records 353 vessel glass entries, and his table in volume 1 (Hanel 1995a: 250) suggests a possibility of 355 vessels. Even with the unpublished fragments found in the assemblage during this study the count only reaches 391 distinct data entries, not all of which can be identified as distinct vessels. Hanel's tally of entries includes fragments that are missing from the assemblage and cannot, at the present time, be recorded as separate individual vessels. When those are counted the number of vessels still does not reach the 455 that he claims are following ceramic forms. A further complication to Hanel's calculation is the fact that that he leaves many of his fragment entries as unidentifiable, suggesting that he could not know if they followed ceramic forms or not.

determine whether or not missing fragments were distinct vessels, and since this was an MNI count most of them had to be counted as potential fragments of counted vessels.

It is unclear how much of the assemblage was produced in the local region, and how much was imported, but evidence for certain forms will be discussed in their relevant sections. Dorothy Charlesworth has speculated that most of the first-century fine glass was imported and that good quality glass only started being produced nearby in the Köln area in the second and third centuries. She admits, however, that local production was possible in certain cases, and allows for local production of ordinary utilitarian wares (Charlesworth 1984: 283). It is notable that there is less Köln cut glass at Xanten than might be expected (Charlesworth 1984: 283), suggesting that the second-century site, which is the main focus of her work, and perhaps even the first-century fortress may not have relied heavily on Köln for glass imports. The reason that she presumes that the fine first century glass is imported is that many of the high quality cast forms, such as the pillar-moulded bowl, have Hellenistic origins and have large Mediterranean distribution patterns which could suggest manufacturing centres in Alexandria, Italy, South Gaul, and the Levant (Charlesworth 1984: 284). While this argument has some merit, it is not proof, because, as Charlesworth admits, the migration of glass-workers could result in high levels of uniformity, and individual characteristics for specific region are next to impossible to define for most glass forms.

5.2.1 Cast Glass

Cast glass represents at least 29 per cent of the glass at Vetera I. This percentage includes core-formed, mould-pressed, and slumped vessels, particularly represented by the pillar-moulded bowl. Despite this significant percentage of cast glass, and the fact that multiple casting techniques are represented, there is relatively little variety in the forms. There are only five forms that are identifiable to the level of Isings' categories, two vessels that can only be identified as cups or beakers, and five vessels that are bowls of unidentified forms. A further 10 vessels are not identifiable. The vast majority (74 %) of the 90 cast vessels can be identified confidently as 'pillar-moulded' bowls (Tables 5.1 and 5.2).

Table 5.1: Numbers of vessels produced through each method of casting at Vetera I.

Core-Formed	Pillar-Moulded	Mould Pressed	Total
1	67	22	90

Table 5.2: Cast vessel forms from Vetera I.

Vessel Type	Isings Form	Number of Vessels
Bowls	?	5
	I 18	2
	I 3	67
Cup or Bowl	? One may be I 12	3
Cup of Beaker	?	2
Plate	I 22	1
Shallow Dish or Plate	I 5	1
Unguentaria	I 6, 8, 26, or 28	1
Unknown	?	10

5.2.1.1 Unguentaria

The one unguentarium that has been tentatively identified as core-formed is surprising for a first-century site where most tubular and bulbous unguentaria were blown. Inventory number 23091 has a texture that sets it apart from smooth-surfaced blown unguentaria and rather than being quite thin and fragile, it is made of a thick, quite robust, very dark blue fabric that is barely translucent. It is definitely cast in some way, but the form would be difficult to produce in a mould due to the difficulty of removing the interior mould from a closed form without breaking either the mould or the vessel. As a result, core-forming is the most likely method of production. The old production method could imply that this vessel was some kind of heirloom item, or an eastern import, but as an unguentarium, it would likely have been traded based on its contents rather than its value as glass, and without knowing what the contents were, it is impossible to determine whether or not it was a particularly high status item. The vessel is also undecorated and monochrome, and had a very simple design. Dark blue was not an uncommon colour in the first century A.D., and is well represented at Vetera I. In fact, the particular deep blue of this vessel is quite prominent in the monochrome glass of Vetera I, and absent from the other sites in this study, which might even suggest a local production, or the use of a specific supplier.

Figure 5.4: Item 23091, the neck of a potentially core-formed unguentarium from Vetera I. (Photo: Jonathan Prior with permission of the LVR Rheinisches Landesmuseum, Bonn).

5.2.1.2 Plates or Dishes

Vetera I yielded only two cast plate or dish fragments. The first (Fig. 5.5) appears to be the mould-pressed variety of a cylindrical dish matching Isings Form 22 (Appendix 1A). This form, which closely matches Dragendorff Form 22 pottery, is thought to be an import from Italy (Hanel 1995 a 240). The Isings Form 22 is rare in the Rhineland, only appearing here and in a mid-first century rubbish pit at Vindonissa, but it is known from Pompeii (Hanel 1995 a: 240; Isings 1957: 38). The fragment from Vetera I is not precisely dateable, but it has a natural translucent fabric in a greyish yellow-green colour that is quite common in vessels of a Claudian-Neronian date (Hanel 1995 a: 240; Hanel 1995 b: 651). As with the plates and dishes at other sites, it is possible that this item had some degree of high status despite lacking decoration. It was found in building M (Fig 5.1), which is thought to have been a tribune’s house, so an individual with wealth levels well above that of a common legionary could have owned it (Allison 2013: 111 fig. 6.2, 113; Hanel 1995 a 240).

Figure 5.5: Item 31615, the mould-pressed base of an Isings Form 22 dish (Photo: Jonathan Prior with permission of the LVR Rheinisches Landesmuseum, Bonn)

The other cast plate (Fig. 5.6) from Vetera I (Cat. E 208, Inv. 25291) is a dark green fabric that has a slight bluish tinge if light is shone through it. It appears to be a fragment of an Isings Form 5 dish (Appendix 1: A5). Despite being cast, most dateable examples of this form come from the second half of the first century A.D. rather than predating glassblowing, which indicates that casting was still a viable alternative to glassblowing, and that the cost of some casting techniques must not have been disproportionately high. This form has a wide-spread distribution with examples from as far apart as Corinth and Colchester, where they have fairly secure Claudian-Neronian dates (Isings 1957: 21). The colour of the Xanten example is not out of line with the common trend for this form, which is a translucent emerald green fabric (Isings 1957: 21).

Figure 5.6 Hanel (1995) Item E 208, Inventory 25291, a dark green, mould pressed, Isings Form 5, dish base. (Photos: Jonathan Prior with permission of the LVR Rheinisches Landesmuseum, Bonn).

5.2.1.3 Shallow Bowl

Vessels matching the shape of Isings Form 18 appear in both blown and cast glass in the Vetera I assemblage, though Isings records this form only as cast. Four out of five entries for this form in Hanel's catalogue are fragments of cast vessels. In spite of having been catalogued separately and said to be four vessels[65] (Hanel 1995 a: 240), close analysis and comparison of the 14 cast fragments from these entries shows that only two to three vessels are represented.

Hanel's catalogue entries E 2 and E 3 (inventory 24051 and 24119) are both fragments of a decorative cane-formed *millefiori* bowl with opaque white and orange-yellow spirals around central reddish-brown dots, on a green ground. Fragment E 3 also has a purple blotch ringed with white dots at its left edge. While these pieces do not connect, the similarity in fabric and decoration suggests that they may well be from the same vessel and cannot be counted as more than one in the MNI of these vessels.

Catalogue entries E 4 and E 5 are certainly from the same vessel, although they were found in buildings F and S across a road from one another (Hanel 1995 a: 240). When the three and nine fragments of each entry were examined together, it was discovered that, not only do they have the same pattern of opaque white and yellow flecks on a green ground, but that fragments in both exhibited three shallow grooves on the exterior walls and an interior groove just below the rim. Furthermore, there were connecting fragments from both entries.

Only one of the fragments (E 2) comes from a context that could be closely dated by stratigraphy. It is from the foundation levels of building G (Fig. 5.1), which Hanel says is close to some pre-Neronian contexts. The other fragments are not dateable, but the form itself tends to appear primarily in Claudian to Neronian contexts

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[65] Hanel records the four vessels as 'E 26,' but this must be a typo, as the I 18 entries are E 2-E 6, and E 6 is not cast. Furthermore, E 26 is catalogued as I 3, though the fragment is missing.

and are geographically widespread, with examples coming from Britain to Afghanistan (Hanel 1995 a: 240; Isings 1957: 36-37).

5.2.1.4 Pillar-moulded bowls

The most prominent cast vessel form at Vetera I is the relatively thick and durable pillar-moulded bowl, which often was the most common glass find on first-century sites (Charlesworth 1984: 287). It has already been well represented in the previous two case studies, and a cursory look at collections from other German sites like Rottweil and Bad Wimpfen in the region of Baden-Württemberg, suggest that this pattern continues throughout the Rhineland. Despite the publication of these sites extending beyond the first century, the pillar-moulded bowl is still one of the most prominent forms, representing over 12 per cent of the Rottweil assemblage and nearly six per cent of the Bad Wimpfen assemblage (Hoffmann 2002: 297-346, 407-427).

Of the at least 67 individual pillar-moulded bowls represented in the Vetera I assemblage, 31 were plain, natural coloured glass that would have been quick to produce, but eight were complex *millefiori* patterns, and at least 19 of the other coloured examples had additional colours added to create marbling effects. Only nine of the pillar-moulded bowls examined (E 41-49) were of a solid colour – mostly shades of blue – meaning that the vessels that could have been produced quickly through slumping, without additional time-consuming steps that might make the finished item costly, total only 39 out of 67 vessels, or 59.7 per cent.

Table 5.3: Colours of pillar-moulded bowls from Vetera I (parentheses indicate the number of multi-coloured vessels in each category).

Base Colour	Complex Millefiori	Light Blue	Dark Blue	Brown	Yellow-Amber	Blue-Green	Purple	Blue-black-purple	White
MNI	8 (8)	2 (1)	8 (7)	9 (8)	2	31	3 (3)	3	1

Table 5.4: Solid colour pillar-moulded bowls from Vetera I.

Yellow-Brown	White	Light Blue	Dark Blue	Blue/black/violet
E 42, E 43	E 44, E 49 (E 49 missing)	E 46	E 45	E 41, E 47, E48

Three of the solid coloured vessels are a hue that appears to be unique to this region, and may indicate local production. This is a colour that Hanel describes in his catalogue as *schwarzviolettultramarin* (black-violet-ultramarine). The description is appropriate as the vessels span that colour range depending on the light and the thickness of the walls. Hanel makes no mention of this colour being unique, but it does not appear even in Rhineland sites as nearby as Nijmegen. No examples of this colour have been identified by the author at any other site, to date, but it appears in other vessel forms in both cast and blown glass in the Vetera I assemblage raising the possibility of a local production centre.

The pillar-moulded style is found in a wide variety of contexts throughout the site, suggesting that it was popular among soldiers, but Hanel has noted that it is least common in the early phases of the fortress. Only two strongly coloured examples can be convincingly dated to the Tiberian occupation The earliest datable strongly-coloured fragment (E 18) comes from a Tiberian pit, and while item E 47 cannot be precisely dated by any other materials, it was found in a burnt layer in building F that may pre-date the 5th and 15th legion camps, leading Hanel to suggest that it, like E 18 was lost in the Tiberian period (Hanel 1995 a: 241). Most of the other securely dateable contexts containing pillar-moulded bowls (E 16, 17, 20, 21, and 40) fall into the Claudian-Neronian range (Hanel 1995 a: 241). Among the natural coloured examples, there are a few examples that may date as early as the Augustan camp. E 58 for example comes from a pit, which contained purely Augustan material, and E 56 was found among rejects of early-Augustan pottery production (Hanel 1995 a: 241). Fragments of this type also appear in Augustan layers at Lorenzberg and Magdalensberg (Hanel 1995 a:

241-242). The majority of colourless vessels also come from Claudian-Neronian dates, suggesting a shift in ownership patterns among occupants of the site. The form was scarce in the early camps on the *Fürstenberg*, but after advances to the riverfront and growth in trade, corresponding to a rise in South Gaulish *terra sigillata*, there was a boom, with high demand, and quick, cheap production of natural glass keeping the price low the bowls became widespread among the soldiers. Similar patterns emerge at other remote Rhineland camps like Velsen I and II, Valkenburg, and Zwammerdam (Hanel 1995 a: 242).

5.2.2 Blown Glass

The blown glass from Xanten Vetera I represents 69 per cent of the entire assemblage. The Vetera I assemblage provides examples of both major types of blown glass: mould-blown, and free-blown. Mould-blowing makes up at least ten per cent of the total glass in the assemblage, and 14 per cent to 33 per cent of the blown glass. Free-blowing represents at least 46 per cent of the total glass and 67 to 86 per cent of the blown glass.

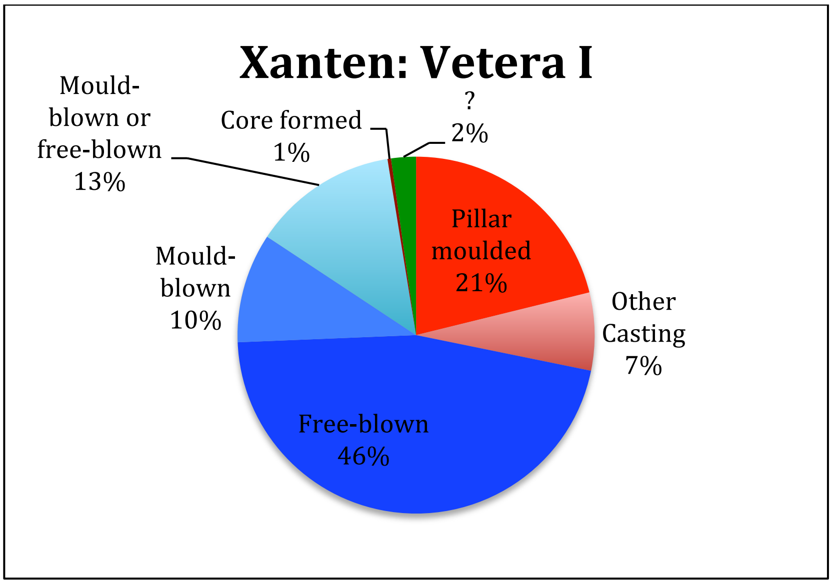

Figure 5.7: Proportions of production types from Vetera I.

5.2.2.1 Mould-Blown Glass

There is a relatively low percentage of mould-blown glass in the Vetera I assemblage. As can be seen in the Figure 5.3, only 10 per cent of the assemblage can clearly be identified as mould-blown.[66] That glass, which is identifiable as mould-blown is of good quality and is, in one case, highly decorative. If the mould-blown bottles are temporarily ignored,[67] we are left with a small sample of ten vessels. Three of these have unidentifiable forms, but among the others there are examples of a one handled cup, three beakers, a well preserved half of a short gladiator cup, a cup or small bowl, and what appears to be a large globular unguent bottle or flask with a decorative lattice pattern.

Table 5.5: Mould-blown vessel forms from Vetera I.

Vessel Type	Isings Forms Present	Number of Vessels
Beaker	I 31, I 32, I 34	3
Bottle	I 50 and I 51?	22
Cup or Bowl	?	1
Cup	Gladiator	1
One Handled Cup	I 36 or I 37	1
Unguentarium or Flask	?	1
Unknown	?	2
Total	---	31

5.2.2.1.1 Cups and Beakers (Appendix 1.B)

Table 5.6: Mould-blown cup and beaker forms from Vetera I.

Description	Isings Forms Present	Number of Vessels
Mould-blown Decoration with Facet Cutting	31 or 21	1
Indented Beaker	32	1
Beaker on a Base	34	1
Gladiatorial Combat Scene	Gladiator Cup	1
One-Handled Cup or Goblet	36 or 37	2

[66] The Maximum percentage that could be mould-blown is 23 per cent, but that is only if all of the glass of uncertain blowing techniques, mostly Isings 50 and 51 fragments, was in fact mould-blown.
[67] Mould-blown bottles will be discussed with the rest of the Isings Form 50 and 51 bottles in the free-blowing section, as is the general practice in glass reports

Only six vessels present in the Vetera I assemblage can be clearly identified as drinking cups or beakers, yet they represent five distinct forms, showing that there were a range of different tastes and different styles of vessel available for the same purpose in this frontier fortress.

The first form, represented by the mould-blown beaker E 131 is an interesting combination of mould-blowing and facet cutting. Hanel records it as simply a facet-cut beaker (Hanel 1995b: 660), but the cut honeycomb pattern is within a large oval indent that has the appearance and feel of being mould-blown, and there are the remains of a small oval facet outside of the moulded intent. While facet cutting is not a typical feature of any of Isings first-century mould-blown forms, this vessel shows that it was a decoration technique that could be blended with moulded decoration on a vessel that otherwise matches Isings Form 31, as was wheel cutting, which Isings mentions (Isings 1957: 45-46). Isings notes that Form 31 would have likely been a costly vessel type due to its varied decoration and rarity (Isings 1957: 45-46). Although Hanel says relatively little about it, other than to point out that it is proof of facet cutting prior to A.D. 70,[68] and that there are no other comparisons, he indicates that it may be one of the few examples prestigious glass, which had declined as general glass use increased, was still in use (Hanel 1995a: 251).

An alternative is that the vessel is actually a member of Isings Form 21 (Isings 1957: 37-38), which is a goblet on a pad base, although no base survives to confirm this. Form 21 is noted to have cut, honeycomb decoration, but it is a rare form, especially when produced by blowing.[69] Form 21 is thought to be a late first-century design, which would make this one an early example of the form, and possibly a prestigious

[68] Facet cutting is common in later decorative Roman glass, but is only noted in a single late first century form (21) by Isings (1957: 37-38).
[69] Most vessels of Form 21 known to Isings were cast. She only knew of one blown example from a late first or early second century context in Locarno, Switzerland (Isings 1957: 37-38).

showpiece (Isings 1957: 37-38). The intricate decoration within each moulded indent, suggests a piece that was more than just an ordinary drinking item for daily use, and that it might have belonged to someone with a degree of wealth and standing to exhibit.

The find location of beaker E 131 may provide some support for this vessel being the possession of someone with higher status who could afford more than the common soldier because the coordinates of its trench (618) place it at the edge of the tribune's house nearest the *principia*. This trench is, however, an example of the long trenches of Lehner, which can often span more than one structure. It encroaches on the area identified as the location of workshops and storehouses, so the status of its owner cannot be certain (Hanel 1995: Supplementary Map 1; Johnson 1983: 246). A luxurious form of tableware may be an indicator of a certain amount of trade, but both potential forms are found throughout the Empire, so a production region is impossible to pinpoint.

Inventory number E 123 is a much less remarkable vessel. It is a simple indented beaker of natural coloured glass with a thin abraded band around the exterior. This is the only representation of Isings Form 32. This beaker form, which can be produced either by mould-blowing, as this one appears to have been, or by pressing in the sides of the hot vessel with tools, is not an uncommon form in the latter half of the first century and second century A.D. and is not unheard of in the Rhineland, as there are at least two known vessels from cemetery excavations in Nijmegen, and one from the *Oppidum Batavorum* assemblage discussed in the previous chapter (Isings 1957: 46-47).

Only one base fragment in the Vetera I assemblage appears to come from a mould-blown beaker, and that is tentatively associated with Isings Form 34 simply due to the presence of a pad base.[70] This fragment is only identified as mould-blown by

[70] Form 34 is the only Isings beaker form of the first century noted to have a pad base (Isings 1957: 48).

texture but has decoration on it. Its domed interior kick indicates that it was finished on a pontil following blowing, but there is then an applied pad base that masks the pontil mark and concave bottom of the vessel.

The most discussed cup in the Vetera I assemblage is an emerald green gladiator cup (E 88) (Fig. 5.8). It is divided into three zones by raised horizontal bands. The gladiator battle is in the central zone and shows the remains of a lion's tail and a gladiator with a crested helm raising his arm to strike with his sword, which is missing. A rectangular shield is near his feet between the gladiator and his opponent. There is a smaller fragment that shows a leg and the bottom of a shield extended to block, but it is not clear what he is facing. In the zone above the gladiator fight there is raised writing that says [---]S PROCVLV[---].

The gladiator cup was found near the foundations in building A, in the west side of the *principia* (Hanel 1995 a: 243; v.2: 657). Its context suggests a mid first-century date, and Hanel suggests origins in Gaul or Italy because the style is widespread in Italy and the western Empire. There is no specific evidence for its site of origin, but it appears to come from a series of cups that name the gladiator Proculus. Other possible examples of this model of gladiator cup are known from at least seven sites in Britain, including the fortress at Usk in Wales, and Colchester, as well as sites in France, Italy, and Spain (Cool and Price 1995: 49 No. 237; Harden 1947: Nos. 50-5). In the Rhineland there are other gladiator cups from Vindonissa (Berger 1960: 56 ff.). One completed gladiator cup from Chavagnes-en-paillers, France reads "SPICVLVS COLVMBVS CALAMVS HOLES" and "PETRAIES PRVDVS PROCVLVS COCVMBVX" (Harden *et al* 1987: no 90), which may mean that the Vetera I may be the same image of Proculus, and therefore, may be from the same series, or even the same mould. Additionally, the Usk vessel (cf. section 3.2.2.1.1), has a 'P,' which Price has potentially linked to Petraites (Price 1995: 151), who is opposing Proculus on the completed French cup, meaning that it too may come from the same series of cups.

Figure 5.8: Vetera I gladiator cup. (Photo: Jonathan Prior with permission of the LVR Rheinisches Landesmuseum, Bonn).

The goblet and one handled cup forms (Isings 1957: 50-57, nos. 36 and 37) are normally found in contexts from the second half of the first century A.D. They are not confined to any one region, and have been found in the case study assemblages for Herculaneum and Nijmegen (Chapters 4 and 6). Catalogue number E 84 is one of two cups of this form from Vetera I, which are both labelled as Form 37, despite them only being recognisable from the 13 centimetre diameter and stepped bevelled edge (Hanel 1995 a: 242). The body shape of these forms is very similar and without the presence of a handle or goblet stem there can be no distinction between them. E84 has a matte Greenish blue fabric that matches chalices found in graves at Nijmegen and Köln (Hanel 1995 a: 242). Of these two vessels, only E 84 shows evidence of mould-blowing. There is a horizontal ridge near the rim before it curves into the body that is indented in the interior suggesting that the vessel was blown into a mould before the rim was turned outward.

5.2.2.1.2 Bowls or Cups (Appendix 1.B)

An unpublished fragment in inventory 30996 (Fig 5.9) is a dark blue rippling fragment that comes from a seashell shaped ovoid cup or bowl (Fig. 5.10). It was boxed with pillar-moulded bowl E 47 but it is far too thin and was clearly blown rather than cast. Its rippling shape, which produces a series of hollow vertical ribs, is a key indicator of mould-blowing. This fragment is the same dark purplish blue, or '*schwarzviolettultramarine*,' colour as the bowl with which it is stored. It is impossible to tell if this colour was intentionally produced in this region without doing chemical analysis. There may be a unique colouring agent, or simply the same cobalt colouring agent as many early first-century vessels used in a stronger concentration. The repetition of very dark examples at this site does seem to indicate a preference at the fortress, for the work of a certain regional workshop that produced this hue, but further evidence is necessary to confirm this. The lack of commentary by Hanel or further publication concerning these colours may, in fact, suggest that there is nothing particularly remarkable about the ingredients in these glasses.

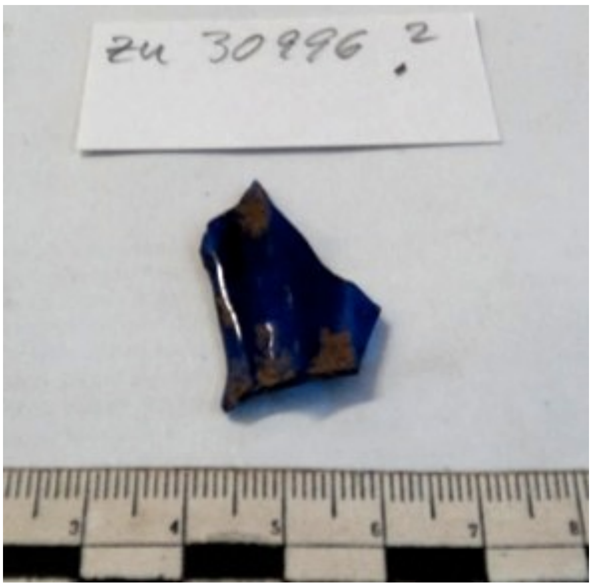

Figure 5.9: Item 30996, a dark blue, mould-blown ovoid cup or bowl fragment with vertical ribs. (Photo: Jonathan Prior with permission of the LVR Rheinisches Landesmuseum, Bonn).

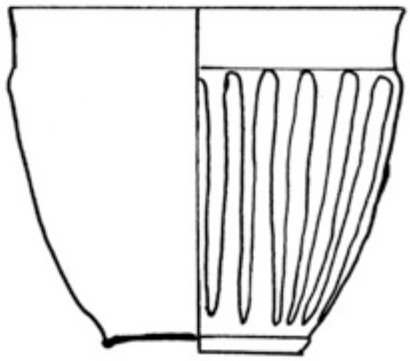

Figure 5.10: Line sketch of a tall ovoid cup with vertical ribs. (After Price and Cottam 1998: 62, Fig. 15).

5.2.2.1.3 Unguentarium or Flask

There is only one possible mould-blown flask or unguent bottle in the Vetera I assemblage. It is a yellowish globular body and neck fragment, decorated with a moulded lattice-work pattern that appears to end part way down the vessel above a wide smooth horizontal band. A mould seam is also visible running vertically through the lattice pattern. Hanel published this fragment (Inv. No. 21460) as an undefined fragment (Hanel 1995b: 666, No. E 242), but it is clear that there it has a vertical neck and a globular body. There is a possibility that a handle could have once been present on a part of the vessel that does not survive, making this a small jug, but the size and curvature makes it more closely resemble an unguent bottle of Isings Form 6 or 26.

Figure 5.11: Item 21460, a fragment of a mould-blown flask or unguentarium with a narrow neck and a bulbous body bearing moulded lattice pattern decoration (Photo: Jonathan Prior with permission of the LVR Rheinisches Landesmuseum, Bonn).

5.2.2.2 Free-Blown Glass

The vast majority of all the glass at Vetera I was free-blown, as one might expect from a mid-first century site, and this technique was used to produce over 140 vessels and almost every form represented falling into nine or ten categories (Table 5.7). Rather than simply re-cataloguing the fragments recorded by Hanel, it is important to accurately calculate the total vessel numbers and see what an accurate tally can add to our understanding of the broad assemblage of the glass from the fortress site.

Table 5.7: Minimum numbers of vessels of each free-blown vessel type in the Vetera I assemblage.

Vessel Type	MNI
Cups and Beakers	33
Bowls	17
Plates or Shallow Bowls	2
Jugs	24
Bath Flasks or Unguentaria	13-14*
Skyphoi	3
Cantharoi	1
Bottles	11**
Jars	4
Unidentified	34
Total	142-143

* One is a possible funnel of Isings Form 74.
** This 11 only includes those that have the texture of free-blown vessels. They are mostly cylindrical.

The body of free-blown glass at Vetera I includes layered glass, painted glass, and glass with applied decorations. It incorporates more than ten different colours or shades of glass and at least nine different vessel types.

5.2.2.2.1 Cups and Beakers (Appendix 1.C.1 and 2)

The 37 inventory entries, which are clearly identifiable as free-blown cups or beakers represent a minimum of 33 vessels (Table 5.8), among which there are only three Isings Forms. The most prominent of these forms is the Isings Form 12 cup, or ‘Hofheim cup,’ with horizontal wheel-cut decoration. This form is prominent in most first-century sites in the western Empire. The remaining vessels are divided between

Isings Form 34 beakers with bases (Table 5.10) a Form 37 beaker, and vessels that could not be assigned a precise Isings Form.

Table 5.8: Free-blown cup or bowl forms from Vetera I.

Isings Form 12	Isings Form 34	Isings Form 37	Cup or Beaker of Uncertain form.
23	5	1	4

Isings Form 12 cups are so common that they are practically defining features of first-century A.D. assemblages in the western Empire. They are among the most common free-blown forms on many sites and are arguably the most common free-blown tableware forms suggesting that they were cheap to mass-produce and were available to a wide cross-section of the population. They are frequently produced in natural bluish-green or greenish-blue glass, but at Vetera I they also appear in seven other colours including the rare blue-violet-black colour that is unique, in this study, to this site (Table 5.9).

Table 5.9: Numbers of Form 12 cups and bowls from Vetera I divided by colour.

Colour	Number of vessels	Colour	Number of vessels
Blue-green	3	**Light blue**	1
Green-blue	6	**Dark blue and white layered**	1
Green-grey	3	**Blue-violet-black**	1
Colourless	3		
Yellow-Amber	1		
Light Green	1		
Dark Green	3		

The Isings Form 34 beaker is similar to the Form 12 cup in that it frequently has horizontal wheel cut decoration, but it is taller in proportion to its width, which is the feature that distinguishes beakers from cups in most glass studies (Charlesworth 1984: 283). Isings Form 34 has a base, which can be either an applied base or a folded ring base, both of which are present in this assemblage despite the small numbers of this form.

Table 5.10: Numbers of Isings Form 34 cups by colour.

Colour	Yellow-green	Greenish-blue	Light green
Number of Vessels	2	2	1

There are two fragments of cups that could fit the form of either a one handled cup or goblet (Appendix 1.C.1.36 or 37), but only one vessel can be counted with any certainty, despite their different find contexts. The first is the catalogue number E 85 (inventory 20251) mentioned briefly above in conjunction with the mould-blown example of this form.[71] The second is an unpublished fine handle and small body portion (inventory 30997) inventoried along with fragments of a square storage bottle.[72]

The four cups or beakers of undefined forms are all shades of blue. One is a natural greenish-blue, one is light blue and two are dark blue. Of these, the three intentionally coloured examples are all unique items that are worth commentary.

Catalogue number E 119 (inventory 31660) is a very dark translucent blue fabric that has dark, almost black, streaks that are visible when light shines through it. It has a base ring around the tiny kick, or pontil mark on the bottom, which hints that it could be an example of Isings Form 34, but not enough of the walls are present to determine its height to diameter ratio. The ring base itself is not an ordinary ring base, but has been shaped to create a uniform ripple effect around its edge (Fig. 5.12). The colour and design would have resulted in a visually striking completed vessel.

[71] This item was labeled a missing in Hanel's report and catalogue (Hanel 1995 a: 242; 1995 b: 656) but was present when the assemblage was examined in January 2012.
[72] It is unclear as to whether this handle was supposed to be inventoried with the bottle, or whether there has been a mistake in the storage or transportation of the assemblage. This fragment could be a missing handle from one of the other examples.

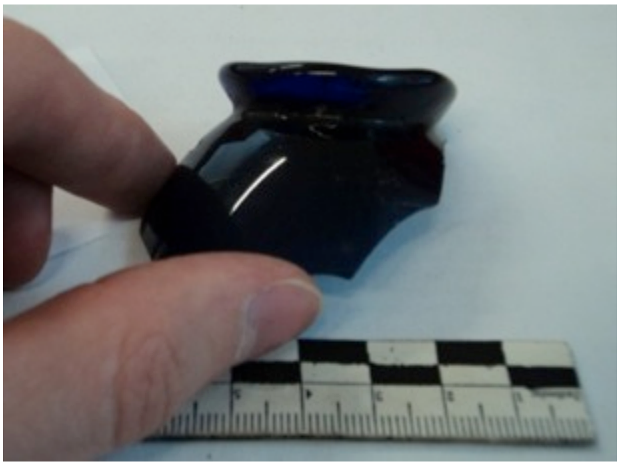

Figure 5.12: Hanel (1995) item E 119, inventory 31660, a black-violet-ultramarine bowl base from Vetera I (Photo: Jonathan Prior with permission of the LVR Rheinisches Landesmuseum, Bonn).

The light blue rim and body fragment catalogued as E 200 (inventory 18193) and the dark blue rim E 210 (inventory 34111) both have opaque white glass decoration applied to their surfaces. The application of opaque white glass makes these pieces decorative, but the application process on blown glass is neither time consuming, nor costly, so their decoration does not identify them as luxury wares. They, along with the dark blue example E 119, may have been visually impressive, but there is nothing about their manufacturing process that marks them as unaffordable. They may be good examples of Vickers' argument that glass was a surrogate for luxury stone and silver (Vickers 1998: 18) wares rather than luxury in its own right.

5.2.2.2.2 Bowls (Appendix 1.C.3)

There are 17 potential free-blown bowls in the Vetera I assemblage identified from 32 fragments. Only five of these vessels have clearly distinct forms, and only three forms can be identified among them. Of the remaining 12 vessels, three are positively identified as bowls and the others fall into the blurred area between bowl and cup.

Table 5.11: Free-blown bowls from Vetera I.

Form	Isings Form 17	Isings Form 18	Isings Form 20	Undefined Bowl	Bowl or Cup
Vessels	3	1	1	4	8

The size and vessel zone of some of the fragments makes it possible that some of these vessels could be considered cups, but this distinction is not critical to this study as long as individual vessels can be distinguished, and similar forms can be compared. The line between cup and small bowl is often hazy when dealing with ancient vessels since we often have no evidence to tell whether a vessel was used for eating, or drinking, or even health and hygiene purposes (Allison 2013: 132-133) in antiquity, and sizes can be similar. Isings Form 17 is a perfect example of a bowl that is frequently similar in size to cups and is as likely to have been used as a drinking vessel as an eating vessel. They are usually found with a diameter greater than their height, but in the case of both examples catalogued by Hanel their rim diameters are smaller than those of the majority of Hofheim cups (Isings Form 12) with calculable diameters. In fact, both of these forms can be considered cups or bowls depending on a researchers decision and the measurements of a given vessel.[73] In the case of Hanel's catalogue he actually uses the term "*Näpfe*," or "bowls"[74] to describe Isings Form 12 and uses the term "*Zarte Rippenschalen*" or "delicate ribbed shells" (*Rippenschale* being the term used to describe the Isings Form 3 bowl) to describe Form 17 (Hanel 1995 b: 656-657). This suggests that he actually does not distinguish between the vessel-type or function, just between the precise forms.

Table 5.12: Blown bowls from Vetera I with rim measurements (After Hanel 1995 b: 656-658).

Isings Form 17	Rim Diameter (cm.)	Isings Form 12	Rim Diameter (cm.)
E 86, Inv. 33720	7.5	E 92, Inv. 22673	9
E 87, Inv. 33720	7	E 97, Inv. 21634a	10
		E 99, Inv. 25153f	9
		E 102, Inv. 26012i	7
		E 108, Inv. 34547	8
		E 115, Inv. 22585	6
		E 116, Inv. 34167	8

[73] If a vessel is wider than it is deep it is often considered a bowl, where it is a cup if it is taller than it is wide so long as it is small enough to easily fit in a hand.
[74] Isings herself allows that the Hofheim cup, Form 12 can be both a cup or a deep bowl and that the distinction often cannot be made from fragmentary vessels (Isings 1957: 27).

One of the three examples of Isings Form 17 (Appendix 1.C.3.17) is actually published as an Isings Form 3 bowl (Hanel 1995b: E 35: Inv. 34403), but it does not have the bulky tooled ribs of a pillar-moulded bowl. It has a pair of fine trailed on vertical ribs and wavy opaque marvered lines for decoration on its dark blue walls. The other two examples have the same fine ribs and marvered wavy lines, but one is amber in colour and the other is clear and colourless. The amber example is unique in that its wavy white lines are only marvered on the ribbed surface, but have been left as raised horizontal ridges above the tops of the vertical ribs.

These vessels are almost certainly imported to this camp as they appear in very small numbers, although remarkably they are relatively popular at other military camps in the Rhineland. For example, there were 26 Isings Form 17 vessels found at Velsen, 12 at Hofheim, and a stunning 63 from Vindonissa (Hanel 1995 a: 242). This still leads to questions of whether they were really so rare at Vetera I, or if there was something about the deposition and excavation that led to them being missed. It is possible that their delicate form made them highly susceptible to severe breakage during the fortress' destruction, resulting in tiny fragments that could be overlooked in excavation, but the same could be said for many forms that are represented. There is still a substantial assemblage containing many very small fragments that were discovered through the careful excavations of Lehner and Hanel.

The fragments of Form 17 from *Castra Vetera* were not found in dateable contexts, but Sophia van Lith's detailed study of the glass at Velsen suggests that the form was present in the region as early as the Tiberian period (Hanel 1995 a: 243; van Lith 1977: 34).

5.2.2.2.3 Plates or Shallow Bowls (Appendix 1.C.4)

Only two free-blown plates or shallow bowls are preserved from Vetera, and only one can be discussed in terms of form due to severe heat damage to the other. Hanel's catalogue number E 8 (Inv. 32753) is an amber rim and body fragment that is just starting to curve into the base. The fragment's rim curvature suggests that the vessel belonged to either Isings Form 46s or 47. Both forms are fairly uncommon, likely have Claudian-Neronian origins, and are most common in Italy (Isings 1957: 61-62) suggesting that they were imported items, which may hold some status. Form 46a is the one that is expected to have a folded rim, like the example in this assemblage, but there is nothing in the description of Isings Form 47, which is defined by its base ring, to prevent it from having a folded rim.

5.2.2.2.4 Jugs (Appendix 1.C.5)

The Vetera I assemblage contains fragments of at least 30 jugs,[75] most of which fall into the Isings Forms 52, jugs with bulbous bodies; or 55, jugs with conical bodies. Eight vessels, listed as E 170- E 177 (E 173 has to be 2 vessels since the handle fragments come from 2 different handles), are recorded in Hanel as Form 55 (Hanel 1995b: 662-663), and a further two can be positively identified as vessels of this form. The remaining 20 vessels do not have enough preserved to determine whether they are Form 52 or 55. Even one of them, which is close to complete, E 181, is missing the lower portion of the vessel so it is impossible to tell if its sides continue to slope outward making it a conical Form 55 jug, or if they curve in to make it Form 52c.

Hanel's E 168, E 346, and E 348 all appear to be from the same vessel despite the fact that E 168 has been labelled as a bottle rim of Isings Form 51 (Hanel 1995 b:

[75] One additional handle may belong to a jug, but has been counted as undefined, because it is missing and cannot be distinguished from a bottle handle (Inventory 33915, Hanel 1995 b: 670, No. E 317).

662). E 346 and 348 are clearly jug fragments, rather than bottle fragments, and E 346 has the single prominent handle ridge of a jug rather than the combed or rounded strap handle of a Form 51 bottle. All three fragments are of sizes and thicknesses that are close enough to each other that they could easily come from different parts of the same vessel. Furthermore the fragments all come from the same trench. This trench lies between high-status tribunes' houses near the hospital (Trench 1391), but the fragments have a utilitarian greenish-blue colouring that would suggest that they were from a practical vessel that was for use rather than show.

5.2.2.2.5 Bath Flasks or Unguentaria (Appendix 1.C.6 and 8)

The number of flasks and unguentaria from Vetera I is quite small when compared to civilian settlements. Perhaps that us due to excavation bias, or the fact that the soldiers' primary bathing facilities have not been identified, only fourteen vessels have been identified in this category,[76] but the small number may also indicate that luxuries were less available to soldiers in this region of the frontier than to civilians or people in established areas of the empire.

The majority of the unguentaria are tubular unguentaria with central constrictions of Isings Form 8 (Hanel 1995 b: 660-661), with a small number of others representing the pyriform Isings Form 26a or possibly the globular Isings Form 6. Several examples not published in Hanel's catalogue also match Form 8, with a slight possibility of Form 27, which just lacks the prominent constriction (Isings 1957: 41). One of the possible unguentaria of this form has a diameter approximately half of that of most Isings Form 8 unguentaria, so it could actually be the remains of a funnel of Isings Form 74 (Isings 1957: 92)

[76] Allison suggests that some small dishes and bowls may also be toilet items, which bring her potential toilet vessel count reach 109 vessels, centred largely around command structures and central buildings (Allison 2013: 132-133).

Table 5.13: Unguentaria forms from Vetera I

Isings Form	6?	8	26a	8 or 74
MNI	1	8	3	1

The only vessel large enough to be called a flask in this category was misidentified by Hanel. His catalogued item E 180, which is missing from the assemblage, is recorded by Hanel as a jug of Isings Form 52 or 55 with a missing handle (Hanel 1995 b: 663). The vessel was, however photographed before it went missing, and was published in the 1912 volume of the *Bonner Jahrbücher* series (Hagen 1912b: 418, Taf. LVIII). The vessel can clearly be seen in to have the shape of an Isings Form 16 flask. It has a slightly conical body with rounded belly and a slight constriction where the neck meets the body and it also has fine groups of abraded horizontal lines around the body, which are frequently seen in Isings Form 16 flasks, and a height of 14.7 cm., where the range for this form given by Isings is 14- 23 cm. (Hagen 1912b: 418; Isings 1957: 34).

5.2.2.2.6 Skyphoi (Appendix 1.C.1.39)

The *Skypho*s form **(**Isings Form 39) is represented, in the Vetera I assemblage, by three vessels, in three different colours. The handle designs for Hanel's catalogue numbers E 89 and E 90 are similar, but not identical. Both have pinched protrusions at the top that form horizontal thumb plates, but these are slightly different. The thumb plate on E 89 directly abuts the vessel wall and the handle slopes down and out from there, where the thumb plate on E 90 is spaced away from the vessel on the edge of a more rounded handle. No handle survives for catalogue item E 91, but there is evidence of one hook protrusion on the rim similar to E 90.

These vessels would have been decorative drinking glasses, likely for high-status individuals. The rims and handles are decoratively formed with hand tools and the quality of the glass is high. E 91 is of exceptionally high quality, with a clarity rivalling modern glass and would certainly have been an expensive, imported piece, although, surprisingly, it was found in the least prestigious context. The colourless example comes from building S, which has been identified as an *immunes* barracks, where the other two vessels come the principia (Building A), and a tribune's house (building R).

Figure 5.13: Hanel (1995) item E 90, inventory 32810, skyphos fragment. (Photo: Jonathan Prior with permission of the LVR Rheinisches Landesmuseum, Bonn).

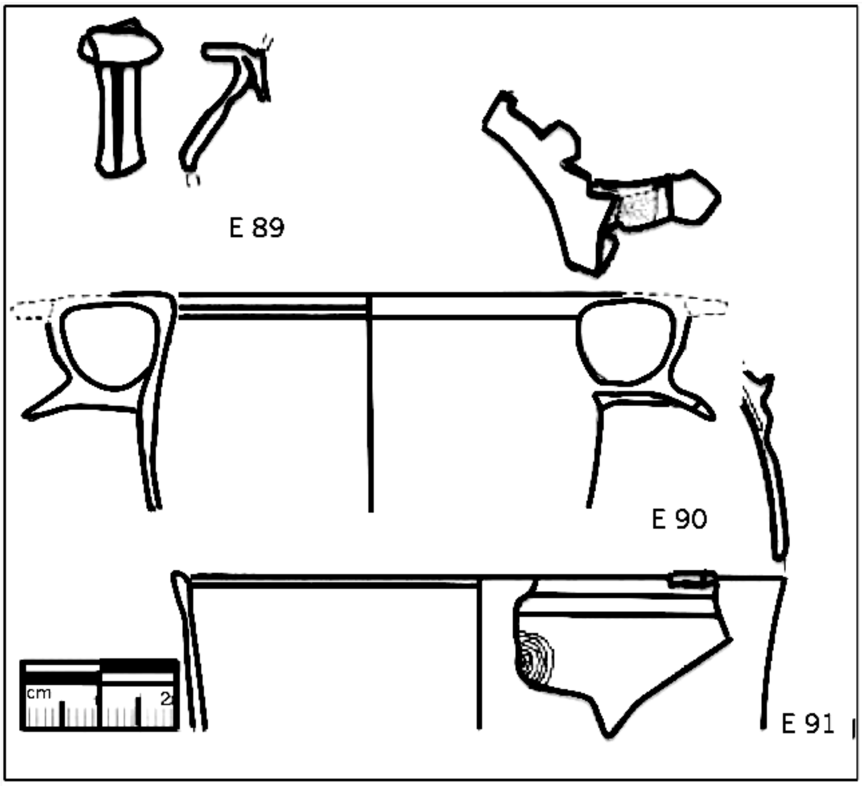

Figure 5.14: Line drawings of skyphoi. (After Hanel 1995a: Table 153).

Figure 5.15: Hanel (1995) item E 91, inventory 33361, skyphos rim. (Photo: Jonathan Prior with permission of the LVR Rheinisches Landesmuseum, Bonn)

None of these fragments come from readily dateable contexts, and the form is rare Germania. The form appears as early as the Augustan period, as is shown by an example from Magdalensberg, but an example that is more likely contemporaneous with these vessels is a *skyphos* found in London dating between A.D. 60 and 80 with a proposed origin in Syria. No solid evidence is provided to explain why Syria is suspected (Hanel 1995 a: 243; Marsden 1980: 70-71).

Table 5.14: *Skyphoi* from Vetera I.

Catalogue Number	Colour	Fragment type	Find context
E 89	Dark Blue	Handle	Trench 370 E 9-F 9 building A
E 90	Black-violet-ultramarine	Rim, body and handle.	Trench 785 F 7 Building R
E 91	Clear colourless	Rom and body	Trench 889 G 9 Building S

5.2.2.2.7 Cantharoi (Appendix 1.C.1. 38)

The *cantharos* is a form (Isings Form 38) that does not appear to survive beyond the first century, and it was not particularly common in glass, even then. Only one fragment of the Vetera I assemblage represents the *cantharos* form. This is a striking red rim and body piece, of variant *c*, with an attached strap handle. In this variant there is a folded ridge around the body of the vessel, just below the rim. Its handles curve up, like in the other variants, but the upper curvature of the handle does not go beyond the folded ridge, whereas on variant *a*, they begin on the rim and arch up above the top of the vessel (Isings 1957: 53-54). The ridge is formed by folding the glass twice just above the handle attachment to create a rounded horizontal roll on both the interior and exterior of the vessel. The rim on this example is capped with a trailed band of opaque white glass.

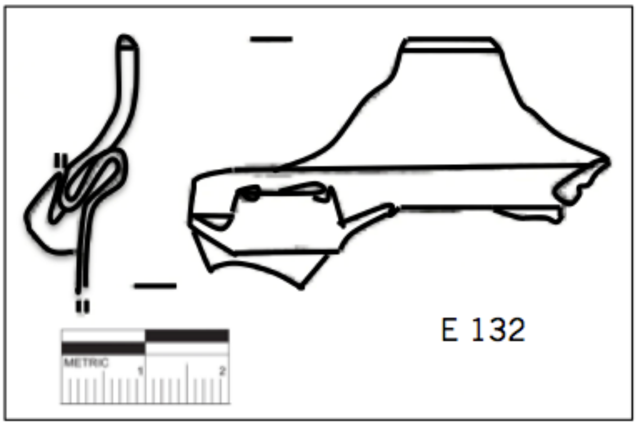

Figure 5.16: Line drawing of a *cantharos* with a folded wall. Item E 13, inventory 18940. (After Hanel 1995a: Table 154)

Figure 5.17: *Cantharos* fragment with a folded wall. Item E 13, inventory 18940. (Photo: Jonathan Prior with permission of the LVR Rheinisches Landesmuseum, Bonn)

This fragment was found in Neronian surface layer 2 in trench 26 which matches it in date to a vessel of this form from Valkenburg (Hanel 1995 a: 245). The form is also known from other Rhineland examples at Hofheim, Erdkastel, and Vindonissa. An example of a *cantharos* of variant *A* even comes from an early Flavian grave at Xanten, but not from the Vetera I fortress. The scattered presence of Form 38 suggests that, while not common, it may have been something that was recognisable as prestige item in this area and was sought after through trade.

5.2.2.2.8 Bottles (Appendix 1.C.11.50 and 51)

There are 63 bottles of Isings Form 50 or 50 in the Vetera I assemblage including the bottles that have undetermined production types. Only 11 of these have evidence that clearly indicates free-blowing. As was noted above, in table 5.5, there were 22 that were mould-blown leaving 30 that are of uncertain production due to the parts of the vessels preserved. Without the walls or base it is impossible to distinguish the production method of these vessels, or often to even tell whether the vessel is cylindrical or prismatic. In this assemblage only 26 are definitely prismatic Isings Form 50 bottles and only five are clearly cylindrical Form 51 bottles.

Six of the bottles have preserved base mouldings. Most of the base mouldings are fairly unremarkable designs like central pellets, concentric rings, and right angle mouldings in the corners. Catalogue E 147 (Inv. 19229), however, has a maker's mark included in the base moulding. Between two concentric rings there is a partial legend [---C]HRESIM[VS--]. The publication of this site knew of no direct parallels have been found for this mark, although the same name has been recorded in Usk, Wales (Section 3.2.2.2.10), but Hanel suggests that the name Chresimus may indicate Italian production (Hanel 1995 a: 246). That said, names of freedmen and Greek slaves were already appearing on *sigillata* from Lyon as early as the Augustan period, and since Roman expansion allowed for the mobility of craftsmen, some of whom would have followed the army or relocated to help establish Roman culture in new colonies, so there is absolutely no reason to say that a person with the name Chresimus from having been working in the Rhineland (Hanel 1995 a: 246).

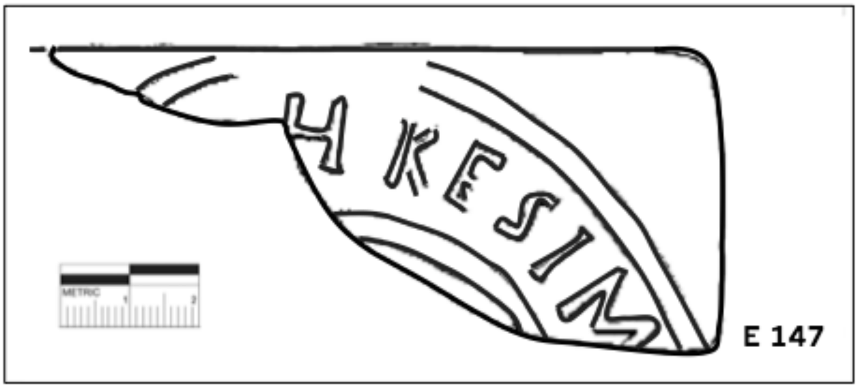

Figure 5.18: Square bottle base (Isings Form 50) bearing the name 'Chresimus' (After Hanel 1995a: Table 155).

Another set of fragments worth mentioning are catalogued as an undecorated square bottle, numbered E 151 (Inv. 33555) by Hanel (1995 b: 661). Hanel missed the fact that the corners are not actually at right angles. By tracing the angles of the base fragment corners it can be determined that at least one of the prismatic bottles from Vetera I was hexagonal, which is and uncommon variant restricted to the Claudian-Neronian period (Isings 1957: 64). Hexagonal variants may have been more for show than their plain, square counterparts, as it is less useful for packing even numbers neatly into crates for transport.

5.2.2.2.9 Jars (Appendix 1.C.10. 67b/c)

The only definite jars in the Vetera I assemblage are five vessels of form I 67 b or c (Hanel 1995 a: 660, Cat. Nos. E 133- E 137), which are bulbous or ovoid in shape and have vertical collar rims. Three of the vessels are represented by the rim alone, so the variant cannot be determined, but the, now missing, fragment E 133 is recorded as being a ribbed body fragment so can be assigned to variant *c*, and there is enough of the rim, body, and base of E 137 to determine that if had no ribs and is therefore variant *b*.

There is one other possible jar represented by a vertical tooled rim, but the tooled rim does not make the production technique for the vessel body clear. E 206 (Inv. 21602) is a dark blue rim with a diameter of 16 centimetres. from the wall debris of the principia (Hanel 1995 b: 665). Hanel did not know what to make of it, calling it a dish or abnormality (Hanel 1995 a: 247), but its size makes a jar, or possibly a bowl form with an everted rim.

5.2.2.2.10 Unidentified

Hanel left a large portion of the assemblage as unidentified fragments, even though many of them were clearly wall or handle fragments of prismatic bottles or jugs, and some others could still be identified, at least to the level of vessel type, by close examination. Hanel (1995b: 664-671) counted 162 distinct entries of unidentified vessel fragments, but only 52 distinct vessels were identifiable in the present analysis. Of these, 37 are blown vessels, five have unidentifiable production methods due to being lost, and 10 are cast and have been noted above in table 5.2.

5.3 Patterns

The number of forms in the assemblage from Xanten, Vetera I was relatively limited as was the over-all number of vessels considering the fortress was occupied for nearly a century. Although there is no evidence of a workshop in the fortress, the relatively low quantity of finds, combined with the presence of a unique colour of glass, suggests the presence of a glass workshop close by that was collecting cullet and producing vessels for use in the camp.

The Vetera I assemblage has an MNI count of 314 vessels, of which at least 68.5 per cent were blown. The majority of blown vessels appear to be utilitarian, although there are some decorative examples with forms or decoration that added a show quality to functional vessels and would have added to the vessel cost. Despite the assemblage being primarily utilitarian, the relatively small number suggests that they were still more costly and prestigious than their ceramic counterparts, which, as will be shown in section 5.5, are found in large numbers across the excavation. Even so, there is no evidence that the ordinary soldier could not afford glass, and glass is found across all excavated areas, although it is worth noting that the excavations have primarily focused on the prestigious centre of the fortress. There could also be a collection bias considering that this was a military site that met a violent end. Free-blown tableware, which is the category in which one would expect to find prestigious items, tends to have thin walls and be highly fragile; making these vessels susceptible to breaking onto many very small fragments that could easily be overlooked. The same fragility could also have made fine, free-blown glass less common than durable designs like the pillar-moulded bowl for military units that had to be ready to move around. Another possible explanation for finding small numbers of fine glass tableware that must be considered, but cannot actually be proven, is that prestige items such as decorative glass may have been looted when the fortress fell to the Germanic rebels.

Casting was well represented at Vetera I, and there is no indication that it was restricted to the highest-level officers. Just under 29 per cent of all the glass on the site was cast. The numbers suggest that this is thanks largely to the popularity of the pillar-moulded bowl form, which is an example of one of the advanced casting techniques that David Grose (1989: 241) credits with starting the spread of glass. Pillar-moulded bowls make up 74.4 per cent of the cast glass in the assemblage, and make up nearly a quarter of the vessel glass assemblage on their own. Nearly half of them (41.79 per cent) were decorative polychrome bowls with either complex millefiori patterns, or simple flecks or marbling within a base colour. Even if all of these were too costly for ordinary troops, for which there is no evidence, there were still 31 pillar-moulded bowls of natural colour, which had widespread usage, and could easily extend into the unexcavated barracks blocks. The decorative fragments alone, which could be interpreted as relatively costly vessels represent a significant proportion of the counted vessels (8.91 per cent), which, since they were not all found clustered in the highest status buildings, could indicate that even these were not restricted to the most wealthy individuals. Without the pillar-moulded bowl, casting would make up a much less significant portion of the assemblage. Less than eight per cent of all vessels were cast forms other than Isings Form 3 indicating that, while not all cast glass was expensive, blown glass was more readily accessible and was preferable for most purposes.

Casting can be confidently identified in a higher number percentage of vessels than mould-blowing, suggesting that the pillar-moulded bowl, at least, was less luxurious, and more accessible to ordinary soldiers than decorative mould-blowing. Mould-blowing, as a whole, is under-represented in comparison to other production techniques, but this under-representation has to come down to the problem of the Isings Forms 50 and 51 bottles, which are not in a vessel category that compares well to cast vessels, or to items that may have served a luxury purpose. Isings argues – and examinations of examples with wall and base fragments support her claim – that the majority of prismatic bottles, at least, are mould-blown (Isings 1957: 63-64), but because it is possible to produce them through free-blowing and pressing the sides and base on a marvering block, examples represented only by fragments from the shoulder and above cannot be labelled as mould-blown in an objective study.

Table 5.15: Vetera I vessel distribution by production category.

Production Category	Technique	MNI Vessels	Percentage of Production Category*	Percentage of Total Glass*
Casting	Pillar Moulded	67	74.44	21.34
	Other Cast	22	24.44	7.01
	Core formed	1	1.11	0.32
	Total Cast Glass	**90**	**100**	**28.66**
Blowing	Free-Blown	143	66.51	45.54
	Mould-blown	31	14.42	9.88
	Unclear Blowing technique	41	19.07	13.06
	Total Blown	**215**	**100**	**68.47**
Unknown Method	**All Unknown**	**9**	**100**	**2.87**
Total Vessels	**All Methods**	**314**	**-**	**100**

* Rounded to the nearest hundredth of a per cent.

Of the 314 vessels counted in the Vetera I assemblage, at least 151, or 48 per cent, bear some type of decoration. This number is not even counting the standard ridged or grooved strap handles on jugs and bottles, or the moulded bases on ordinary storage bottles. If storage bottle bases and handles are included in decoration numbers the total reaches 201, or approximately 64 per cent of the vessels in the assemblage, and it is unlikely that most decoration added to the value of the glass. Much of the decoration is in the form of ribs, but it can include folds in the glass, moulded designs – like that on the gladiator cup – marbling, *millefiori* patterns, or layering of different coloured glass. The fact that approximately half the glass vessels from Vetera I bore some form of decoration, and at least 127 vessels (40 per cent) were intentionally coloured or decolourised (97 vessels are both unnatural colours and decorated) shows that the glass was meant to stand out where it was used, but that it was still meant to be practical, and its numbers show that both blown and cast vessel types were widely affordable.

While it is possible to use the decoration; colouration; vessel type; and, in some cases, contextual information to make inferences about the status of glass, it is impossible to create a definitive list of luxury items for the comparison of production techniques. It is possible to get a rough idea of the proportion of vessels of each that could possibly have been considered luxurious or prestigious items and to test whether or not cast vessels at Vetera I may have been more likely to be 'luxuries' than blown vessels. After going through the sections above and identifying examples of forms that are uncommon, colourless vessels, and decorative vessels, some of which, from each category, are from elite find contexts, it was possible to come up with a maximum number of 'luxury vessels' of both blown and cast glass, and the percentage of the production type represented (Table 5.16). The results would indicate, at least on the surface, that cast glass was more likely to be luxurious than blown glass, as there are more potentially prestigious vessels that were cast rather than blown, despite a lower overall number of cast vessels in the whole assemblage. This might suggest that glassblowing was producing more affordable goods and was spreading glass use, but the percentage of cast glass that was high status is still lower than one would expect if it was, by nature, more costly. The fact that only a maximum of 35.56 per cent of the cast glass has any evidence that could point luxury status clearly indicates that cast glass was more widely used for affordable utilitarian glass than for luxury goods. The low proportion of luxury goods in both cast and blown glass is diminished much further, when it is considered that these maximum estimates likely include vessels that, while attractive, did not have features that would have added greatly to production time and expense. Furthermore, some vessels, such as the plates or shallow dishes, of which there are two in each production category, are only included because these forms are rare among the glass assemblages studied here, and there may have been less need to use glass for plates than for other vessel types. The cast vessel count also includes the core-formed unguentarium (Section 5.2.1.1), which is again only included for its rarity. Unguentaria were not necessarily for show, as they were used in toilet and medicinal activities, and its form is like that of blown unguentaria, so it would not stand out if a person did not know how it was made. It is possible that an unguent producer may have used a more costly or distinctive packaging for demonstrating the prestige of a high status product, as is not uncommon in perfumes or drink containers today. If this were the case, the luxury status and cost would have had more to do with the contents than the glass itself. Again, this can only be speculation, and is perhaps a somewhat anachronistic proposal. For the majority of the vessels in this table, luxury status must, therefore, be considered questionable, and it becomes quite clear that the majority of glass, whether cast or blown, was available to those outside of the social elite.

Table 5.16: Possible luxury vessels from Vetera I (Maximum based on calculated MNI vessels).

Cast		Blown	
MNI	**% of Cast Glass**	**MNI**	**% of Blown Glass**
32	35.56	16	7.44

The forms of glass present on the site suggest that glass use probably revolved largely around eating and drinking, which are activities in which the glass could be seen, and prestige items could be flaunted. There must be some apprehension with this statement since Allison argues that glass is very difficult to associate confidently with a specific activity, and she groups most tableware items in a category that includes tableware, serving, and toilet items. She then completely omits it from her discussion of the distribution of items used for toilet activities (Allison 2013: 132, 300-316). When looking at all production types together, vessels that are considered here, to be probable tableware – cups, beakers, *skyphoi*, *cantharoi*, plates, bowls, and shallow dishes – make up at least 57 per cent of the vessel glass assemblage, likely also encompassing a substantial portion of the unidentified 16 per cent of vessels. Of the 178 examples of glass tableware at least 58 (33 per cent) were types of drinking vessels, and 30 (17 per cent) were for pouring liquids. This means that at least 50 per cent of the glass tableware was for items that would benefit from glass not imparting a taste or scent to its contents, and not absorbing liquid contents making it hard to reuse: Factors that were appreciated by Roman writers (Tatton-Brown 1991: 74). The same reasoning could apply to a large portion of the other 50 per cent of tableware, because many bowls may also have been used as drinking vessels as easily as for eating.

Glass cannot be argued to be just a surrogate for luxury goods, as it was not all on show. Simple storage and transport vessels made up 21 per cent. Most of these were bottles, which would be useful for the same reasons of taste and odour that made glass jugs and drinking vessels valuable. They were also easy to pack for transportation, and would have been useful for brining Roman food supplies to the frontier without it spoiling.

A further 16 per cent of the glass was for unguentaria and flasks, which may be regarded confidently as toilet items. These may or may not have been used to show off prestige, as toilet activities and bathing were not private affairs in Roman times, but their absence does not mean they were uncommon, as they may simply not have been present within the fortress if soldiers utilised services in the nearby *Oppidum/vicus*, or they may have been missed since the excavations omit most of the barracks blocks and have not identified a fortress bath house in which such items would likely be found if they had been lost.

Table 5.17: Numbers of vessels of each tableware type from Vetera I.

Type of Vessel*	Number of Vessels
Drinking Vessels	58
Eating Vessels (Bowls and Plates)	90 (83 and 7)
Serving Jugs	30
Flasks or Unguentaria	16
Storage Vessels (Bottles & Jars)	68 (63 and 5)
Unknown	52
Total	**314**

*Numbers include those of all production types and of unknown production types.

5.4 Distribution

While glass was found in contexts across the excavated area of the fortress, it appears that many of the finest examples were limited to prestigious areas centred on the *Principia* and *Praetoria*, which were themselves at the centre of the 1910-1912 portions of the excavations[77] (Fig. 5.1) (Allison 2013: 132-133; Lehner 1912a: 332-340). Most of the fine glassware, including nine of the polychrome cast vessels, come from the oldest layers, and was situated around the command centre, possibly indicating that more prestigious forms arrived with the early officers. Find distributions indicate that the number, variety, and spread of glass vessels increased over the lifetime of the fortress with naturally coloured glass being found across the entire excavation. Strongly coloured monochrome vessels, which were at the height of their popularity in the early- to mid-first century appear in early fortress layers, but are also found in later layers including among the destruction rubble of the *praetorium*. These came primarily in the form of unguentaria, small bowls, ribbed shells and plates (Hagen 1912b: 398-400). Allison suggests that many of these items had may have been associated with the bathing habits of the wealthy legates, but there is also a strong possibility that most of the bowls were used for dining, since find locations are also full of ceramic tableware and many are found in public areas (Allison 2013: 132-133). Glass vessels are also identified in buildings identified as shops along the *via principalis* (buildings C and D), which were gravelled over and have been tentatively identified as a market; the hospital (building Z); barracks blocks (building Y); and the possible *schola* (buildings T and U) (Fig. 5.19; Table 5.18) (Allison 2013: 133-146).

[77] The 1910-1912 seasons of excavation at the Vetera I fortress (excavations were carried out from 1904-1914 and from 1925-1933) focused on Claudian-Neronian layers of the *Praetorium*, the *Via Principalis*, the left *porta principalis*, the street north of the *praetorium,* and a building just south of the *praetorium*, with pre-Claudian layers being dug in the *Praetorium*, a cemetery, the barracks pits and foundations along the *via principalis*, and some Augustan remains just east of the fortress (Hanel 1995a: xi; Lehner 1912a: 332-340).

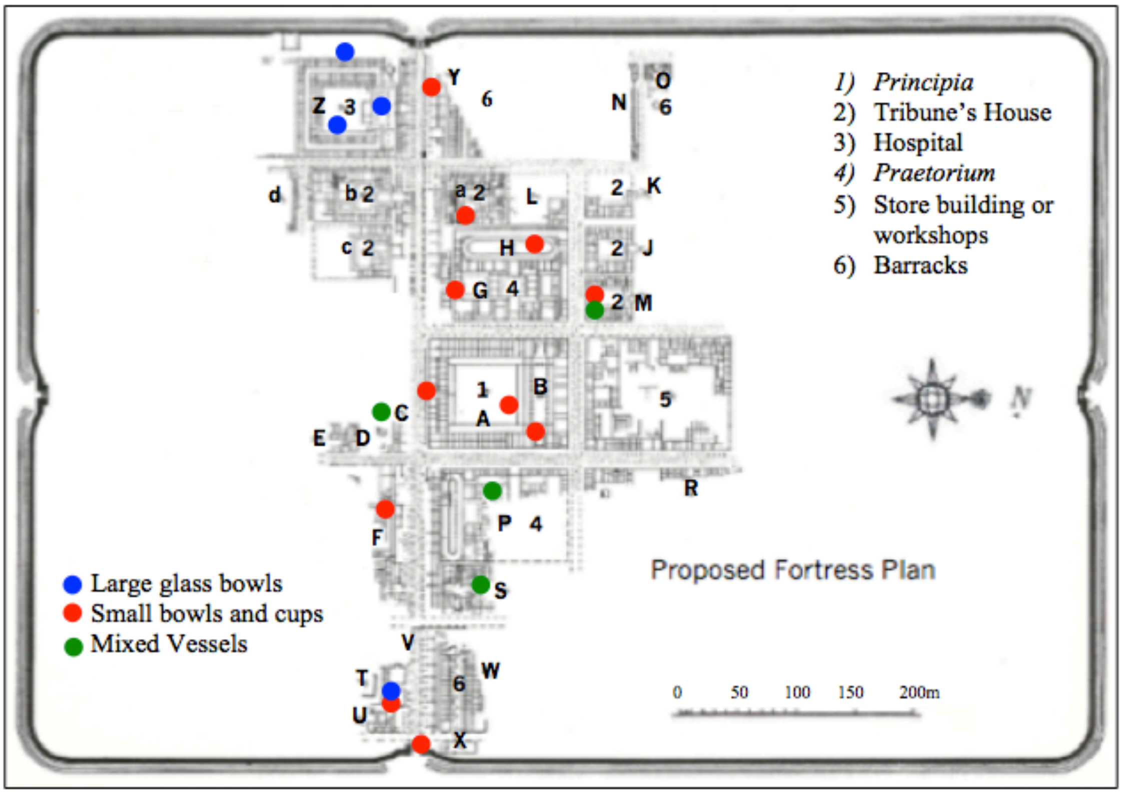

Figure 5.19: Areas where Allison has identified tableware and serving/toilet vessels. Dots mark general cluster areas. Precise find locations within trenches are rarely given (After Allison 2013: 111, fig. 6.2, 132-147; Hanel 1995 a: Table 169; Johnson 1983: 246).

Table 5.18: Identifications of fortress buildings based on interpretations by Hanel (1995), Lehner (1930, 1929), and Petrikovits (1975) (After Allison 2013: 113-114).

Building	Identification	Building	Identification	Building	Identification
A-B	*Principia*	**L**	Utility building	**T-U**	*Schola* (?)
C-D	Shops or *Tabernae*. Gravelled over for an open area	**M**	Tribune's house	**V**	Barracks
E	Unidentified	**N**	Infantry barracks	**W**	Unidentified, possibly barracks
F	Officer's administrative building	**O**	Infantry barracks	**X**	Unidentified
G	*Praetorium*	**P**	Legate's palace	**Y**	Barracks
H	Legate's palace	**Q**	Probable tribune's house	**Z**	Hospital
J	Tribune's house	**R**	Probable tribune's house	**a,b,c,d**	Unidentified
K	Tribune's house	**S**	Utility building; *immunes* barracks		

5.5 Relationship to Pottery

Unsurprisingly, as is the case in virtually every Roman excavation, ceramic vessels outnumber glass. The scale to which this is true in the Vetera I assemblage is colossal. Hanel's catalogue records 8,284 entries for ceramic vessels. Even if we eliminate the entries that are just lids and could easily come from another vessel represented in the list there are still 8,046 ceramic vessel entries to compare to Hanel's 353 entries for vessel glass, which can be narrowed down to an estimated MNI of 314 vessels. Naturally, as with the glass, some of these entries are likely from the same vessel, but ceramics are frequently more reliably identified.

While it was suggested above that Vetera I may have housed some local glass production, due to the presence of a fairly unique "*schwarzviolettultramarin*" colour that has not been found to be mentioned anywhere else, the presence of pottery kilns containing the remains of cooking pots, beakers, and bowls make it clear there were at least craftsmen skilled in fire-based vessel production industries at the fortress (Hagen 1912a: 344). This, of course, is no proof of glass production, which would require glass waste, vitrified slag, blowpipes, or moils to confirm, but it does show that they had the necessary conditions for high temperature fire-based production. The construction of pottery kilns and glass furnaces required similar materials, technology, and skills. It also reinforces the evidence that legions contained, or attracted as followers, many skilled specialist labourers.

Several of the ceramic forms are not vessels one would expect to find in glass and served purposes for which ancient glass was not used, so they can be omitted from any further comparison to the vessel glass. These include cooking pots, *dolia*, and most of the large transport and storage amphorae, since glass was not used for the same scale of storage, was too fragile to use in some of the largest transport vessel forms, and it was not practical to use for cooking, when cheap coarse-ware ceramics would work without the risk of melting. Where ceramic vessels without close glass equivalents can easily be recognised, the opposite is rarely true. The only glass vessel types from Vetera I that were not well represented by ceramic equivalents are the small perfume bottles and unguentaria (Hanel 1995b: 90-226).

If glass was taking over the tableware market, or aspects of that market one would expect to see very little crossover in forms, or evidence for glass being used as a luxury alternative. Since there is no hard evidence for the price of glass before the fourth century Price Edict of Diocletian (Price 2005: 179), it is difficult to say whether it was much more luxurious than glass or not, other than by accepting Roman writers' praise of its qualities (Petronius, *Satyricon* 50; Seneca, *Epistulae Morales* 90.31). The Price Edict provides evidence from glass being 10 to 20 times the price of an equivalent ceramic vessel (Stern 1999: 462), but this is after more than 200 years of inflation, from the period of this study, and a restructuring of the Roman currency, and may not have reflected the Western market as it was composed while Diocletian was residing in Antioch (Stern 1999: 461).

What can be seen instead of a vast difference in forms is a great deal of crossover. There is relief *sigillata* similar to decorative mould-blown wares; ribbed vessels like Isings Form 17; cups with horizontal line decoration like Isings Forms 12, 29, 30 and 34; plates and shallow dishes, storage jars, and bottles and jugs similar to Isings Forms 50 and 51 (Hanel 1995a and b; Section C).

Table 5.19: Numbers of glass forms from Vetera I with similar ceramic counterparts.

Vessel Type and Relevant Glass form	MNI Glass Numbers Vessels	MNI Ceramic Vessels
Relief decoration (Gladiator Cup)	1	189
Hemispherical bowls on bases (Isings 20 and 44)	1	539
Fine-ribbed bowl (Isings 17; Price and Cottam's tall ovoid cup 1998: 62)	4	3
Hemispherical cups with wheel cut horizontal decoration (Isings 12)	23	64
Shallow dishes and plates (Isings 5, 18, 19, 22, 23, 45-49)	8	198
Jugs and bottles	94	2127
Storage jars	5	1145

The number of relief *sigillata* vessels is clear proof that decorative items were sought after and accessible to members of the legions, and that decorative mould-blowing, though able to achieve similar results, was not threatening that aspect of the market. The only relief decorated glass vessel is the green mould-blown gladiator cup. The ceramics show a much wider range of decorative forms including floral patterns, animals, and human figures (Hanel 1995a: tables 65-74; Hanel 1995b: 125-142). Item C 5 (Hanel 1995a: Table 65; Hanel 1995b: 125) even has an image of a warrior with a shield and spear. Another decorative chalice recovered in the 1910-1912 excavations shows highly detailed scenes of people reclining with food and drink while musicians perform (Lehner 1912b: 421-425).

There are numerous bowl forms ceramic bowl forms that are very similar to the forms that are seen represented in glass. Approximately 539 ceramic vessels call into hemispherical forms with ring bases similar to Isings Form 20 and 44 bowls of which there is only one confirmed glass example form Xanten, although they are common in the first century with at least 25 examples presented in the Herculaneum study in the following chapter. Only least 3 vessels closely resemble the Isings Form 17 fine-ribbed bowl, or Price and Cottam's tall, oval, ribbed cup, albeit with a base on two of them

(Hanel 1995 b: 235, 631, Nos. C 1958-C 1059, C 8276; Price and Cottam 1998: 62), which might suggest that either the ceramic form was potentially less common and more luxurious than other ceramic forms, or that they are simply no less luxurious than their glass counterpart, which has nearly identical vessel numbers. One other glass bowl variety does not appear here, but is worth mentioning, because its ceramic counterpart is well represented. There were 163 (Hanel 1995 b: 142-153, Nos. C 191-C 353) pottery examples of conical bowls matching Isings Form 41 b, which appears in at least four examples at Herculaneum.

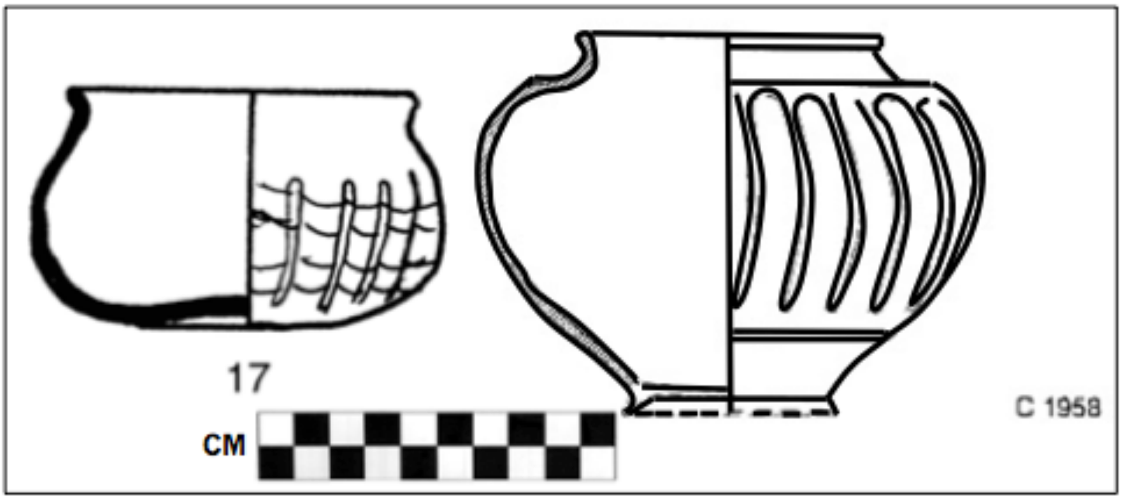

Figure 5.20: Line drawings of fine-ribbed glass and ceramic bowls (After Isings 1957: 35; Hanel 1995 a: Table 102, No. C 1958).

The numbers of hemispherical cups with wheel cut decoration do not differ as greatly as some other forms, although the ceramic variety does outnumber the glass by a factor of almost 3:1. The high numbers of this sort of glass cups (Isings Form 12), which are noted as a popular form in the first century (Isings 1957: 27-30) and appear at all of the western sites in this thesis suggest that this was a common item that would not have served as a costly luxury vessel. This was a form that soldiers clearly could easily afford, but being more fragile than ceramics they may either have been less well represented in the archaeology, or the ceramics might have been more popular for soldiers on the move.

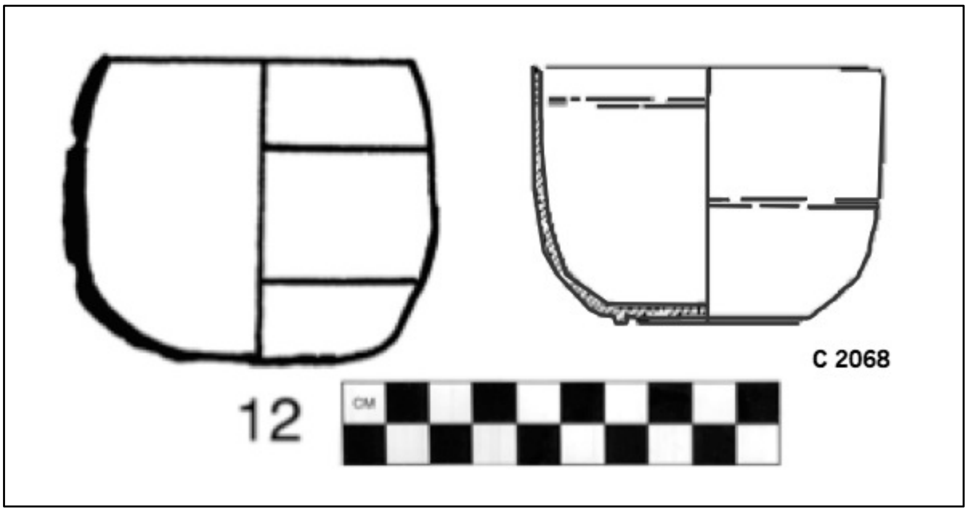

Figure 5.21: Line drawings of Isings Form 12 grooved cups (After Hanel 1995 a: Table 104, No. C 2068; Isings 1957: 28).

Plates and shallow dishes are almost all made from ceramics rather than glass with 190 more examples of the former than there are of the latter. This has been the pattern in every case study that has been examined for this thesis suggesting that large glass plates may have been too fragile for everyday use and may have been for show more than their ceramic counterparts.

Small storage and serving vessels are not completely omitted from comparison, as there are nearly 100 glass jugs, bottles and storage jars. While they may have been prized for their clarity and lack of taste and odour, and while we cannot say with certainty that they were any more expensive than ceramics before the fourth century,[78] they are more fragile than ceramics for transport and that may have influenced the degree of popularity at a frontier outpost such as Vetera I. Whatever the reasons may have been, ceramics in in the jug, bottle, and storage jar categories totalled an estimated 3272 vessels leaving the glass in the minority by a factor of more than 32 times.

[78] Diocletian's Price Edict puts the price of a pottery vessel with a capacity of two *sextarii* (*circa* 1.094 litres) at 2 *denarii*, and a vessel of equivalent size in plain Judean glass would have weighed about one pound and therefore would cost 20 denarii (Stern 1999: 462; Diocletian *Price Edict* 16.1-9.

5.6 Conclusion. Contextualising the Data

Vetera I provides a fairly limited assemblage of glass, for having been a large site with an extended period of occupation. While glass was certainly being used by a far wider range of society than it would have been in the century before the construction of *Castra Vetera*, it appears that it was still not something that everyone was using in large numbers. Some of the vessel types that appear seem to have been imported due to their low numbers, and it is possible that there were a number of prestige items. Even those prestige items, however, are generally unlikely to have been vastly more costly than the cheapest glass, and may fall more readily into the category of 'surrogate luxury' goods, rather than 'luxury' goods. Most of the vessels that could be considered above basic utilitarian status still tend to be fairly ordinary, practical forms with slight decoration or attractive colours, rather than particularly intricate or delicate forms. These would be things that look nice, but were not unattainable to soldiers on an annual wage of 225 *denarii* per year (Alston 1994: 114). Only the most basic, utilitarian forms appear in great numbers and there is very little evidence for fine tableware. The strong presence of thicker, more durable, and ordinary utilitarian forms, and lack of delicate decorative forms could be a result of deposition or excavation bias, but there is some evidence to suggest that it is also indicative of a military base (see Chapters 3 and 4), where there would have been a need to have items that cheap to discard and replace, or easily transportable, and where luxury goods would have been largely limited to officers.

The ratios of glass production types show that glassblowing was the most common method by a significant margin (approximately 69 per cent ± 2 was blown), but that it was not as dominant as might have been expected. It appears that slumped bowls such as the pillar-moulded form, were cheap enough and readily available enough to be popular among soldiers and that their use actually grew over the life of the fortress, rather than declining as glassblowing increased, lending credence to Grose's (1977: 9; Section 1.1) argument that glassblowing was not the sole reason for the shift in glass usage in the Roman world. The fact that cast glass makes up over one quarter of the assemblage of a fortress that was founded following the invention of glassblowing, and ceased to be occupied more than 100 years following the invention of glassblowing, and the fact that much of the cast glass was a fairly simple practical design provides a strong case that, while glassblowing was becoming dominant, glass use was not only made accessible to a wide market through glassblowing technology.

The glass from Vetera I does not appear in high enough quantities to suggest wholesale replacement of any ceramic forms. Many of the glass forms represented seem to be more lustrous supplements to the ceramic assemblage, and indeed imitate virtually the same forms. The glass assemblage is largely made up of tableware, but the vast quantity of tableware, especially when considering plates or shallow dishes is still made up with ceramics. The primary function of glass vessels seems to be as a container for liquids rather than as a platform for food, a role that could be carried out just as well by pottery.

Chapter 6 : Herculaneum and Pompeii: Urban Environments at the Heart of the Empire

6.1 Introduction

This chapter moves away from the context of Rome's western provinces and militarised frontier, focusing instead on the use of glass in the centre of the Roman world. The two cities chosen to represent the heart of the Roman world had long histories and had been fully Romanised well before the invention of glassblowing. This chapter examines evidence from two of the most famous archaeological sites in the world, which have been subject to extensive excavation and conservation for well over a century. The primary focus will be on the glass recovered from the five-hectare open excavation at Herculaneum running from the *Decumanus Maximus*, at the southern edge of the forum, down to the ancient shoreline, and divided by three *cardine* (Fig. 6.1). This site provides the opportunity to examine the glass that was used in a range of contexts including wealthy Roman homes; poorer, multiple-occupancy, residential buildings; bath complexes; shops; and *tavernae*. The forms in use will be contrasted with vessels from a limited study of glass from the nearby city of Pompeii, which was a larger, busier business centre. The Pompeian glass forms being discussed primarily come from four buildings, to which significant numbers of vessels can be attributed. These buildings are *Casa del Menandro,* I, 10, 4*; Casa di Lesbianus,* I 19,9; *Casa di Giulio Polibio,* IX, 13, 1.3; and the *Hospitium* from *Regio* I, 14, 9 (Fig. 6.2). A further study of several *Regio* I buildings, by De Carolis (2004), provides a comparison of glass usage to other materials at Pompeii in five different contexts representing different social and economic levels.

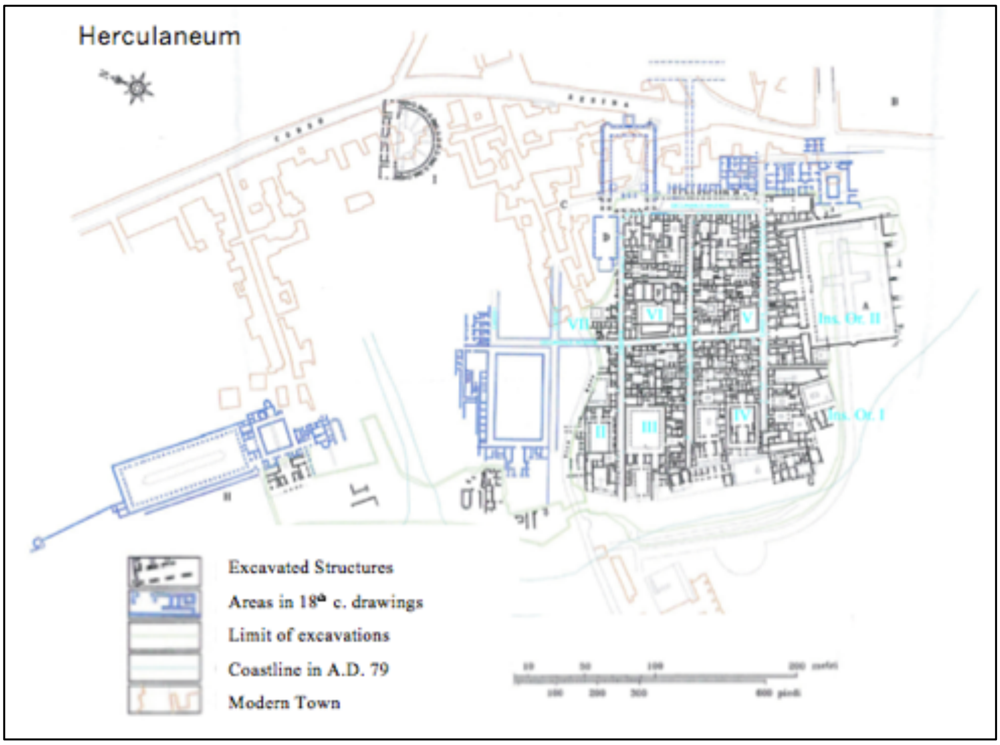

Figure 6.1: Map of Herculaneum excavations (After Grant 1971: Map 4).

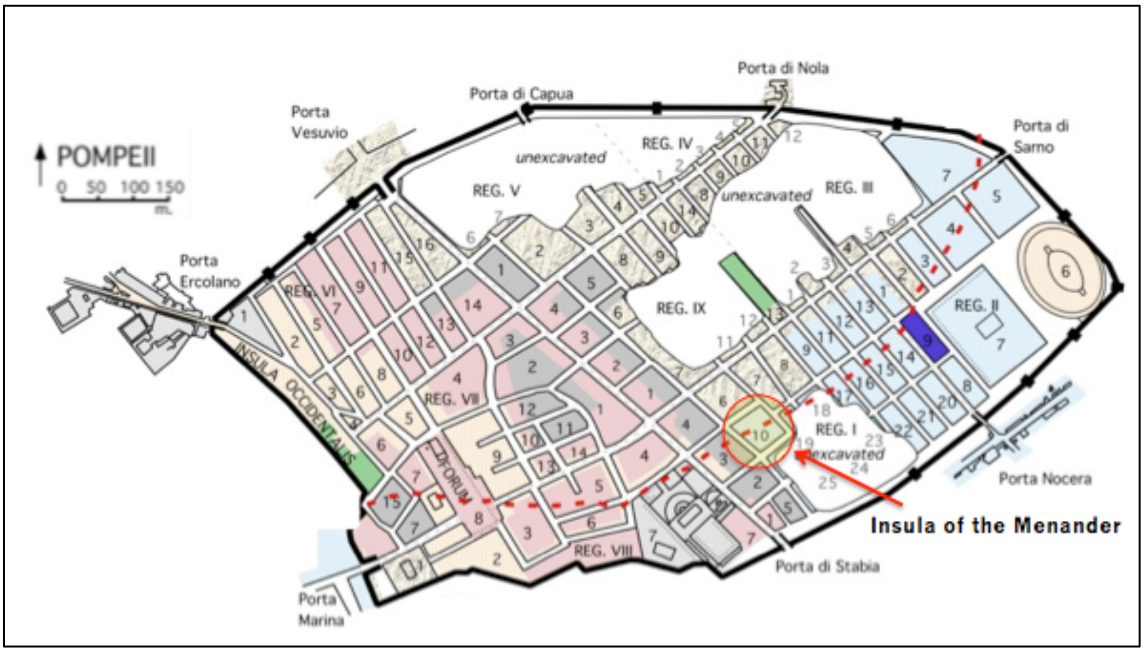

Figure 6.2: Map of Pompeii excavations with the 'Insula of the Menander' highlighted (After Grant 1971: Fig 3).

6.1.1The Sites

The ancient Campanian cities of Herculaneum and Pompeii are most famous for being buried by the A.D. 79 eruption of Vesuvius, which preserved the streets, buildings, and people of these Roman cities on an unprecedented level, as well as for having been recorded by contemporary witnesses. These sites are often touted as 'snapshots' of first-century Roman life that are not visible on the same level anywhere else, making them ideal for examining the contexts in which objects were used.

It had been hoped that, since both of these cities had long and prosperous histories before the disaster, and even before the spread of Roman influence to the Bay of Naples, they would provide a timeline of glass use from before glassblowing to the eruption, but this proved impossible due to excavation biases that focused on the A.D. 79-eruption layer, and the extremely limited exploration of earlier contexts. As a result, they do not allow for a continuum study of glass, use, but they do allow for a more in-depth study of the social contexts in which glass was used than any site previously examined in this thesis.

The founding of Herculaneum goes back beyond its recorded history[79] and has never been precisely situated in time through archaeology or historical records. What is known about its history makes it a useful site for comparison because, unlike the preceding sites, it predates the use of blown glass by several hundred years,[80] and it was culturally Roman before glassblowing. Herculaneum can therefore be used as a test for of how whole-heartedly a pre-existing Roman society adopted the new technology of glassblowing. Herculaneum, although only reaching a maximum area of about 12 hectares (Grant 1971: 20), has a similar city plan to Naples, with a regular grid and an estimated 16 *insulae.* Maiuri made this estimate based on the natural confines of the

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[79] Dionysius of Halicarnasus (I, 35) claims that Herakles founded the city to thank the gods for the success of his tenth labour (Deiss 1989: 6; Maiuri 1959: 5).

[80] Pottery evidence from the nearby island of Ischia shows that there had been some Greek presence in the region as far back as the 8th century B.C., but there is also substantial evidence of Italic Oscans living in the area, as they were the builders of the first walls at Pompeii.

promontory on which Herculaneum sat,[81] and the assumption that the portion of the city on the opposite side of the forum from the excavated remains would be organised in a mirror image street plan as has been seen in other Greek colonies in Campania including Naples (Maiuri 1959: 10-12).

The origins of Pompeii are also lost to history, and its high quality of preservation has hindered explorations into its earliest phases. While there have been some small test excavations into layers predating the A.D. 79 eruption,[82] and some evidence for Pompeii's earlier history can be witnessed in the building materials prevalent in standing structures,[83] tourism and the preservation of standing structures prevent large-scale research (Fulford *et al.* 1999: 37, 40), which would allow for a chronological study of glass use among other explorations. There have, however, been detailed studies of the distribution of household objects in several parts of the city (Allison 2006; Allison 2004; De Carolis 2004), making it a good site to compare with Herculaneum, even without the opportunity for extensive personal examinations of excavation records and assemblages.

Pompeii and Herculaneum have similar histories in the last four centuries B.C. They both came under Rome's sphere of influence, and became culturally Roman before officially falling under Rome's power. They both were *socii* (allies) of Rome from before the first Samnite war (*circa* 343 B.C.), and became part of an important sea

[81] Before the eruption of A.D. 79 Herculaneum sat on a narrow promontory bordered by ravines containing mountain streams to the sea. These streams were not navigable and the site lacked a good natural harbour meaning Herculaneum never grew into a major trading centre, but just a transit town along the coast road. The landscape was levelled out and the promontory nearly disappeared following the eruption, which raised the ground level by more than 20 metres (Grant 1971: 20; Maiuri 1959: 5).
[82] Maiuri made some test excavations, between the 1926 and 1942 excavation seasons, discovering third century B.C. levels below the House of the Surgeon, and votive offerings dating as far back as the sixth century B.C. in the Temple of Apollo and the Temple of Minerva and Hercules in the Triangular Forum Fulford *et al.* 1999: 39; Grant 1971: 15-17). Most of the sixth century evidence comes from fragments of Etruscan *bucchero* pottery, some of which bears Greek inscriptions leaving it uncertain as to which culture founded the city (Descœudres 2007: 14).
[83] There have been some suggestions that Sarno limestone, tufa, and lava bricks were primarily used in the Etruscan, Samnite, and Roman periods respectively (Fiorelli 1873; Fulford *et al.* 1999: 37).

trade network for Rome that was based around the Bay of Naples (Deiss 1989: 84; Grant 1971: 15, 17, 22). They finally became Roman official colonies after their participation in the Social Wars of 91-89 B.C. Due to this long connection with Rome, and the long influx of Roman culture, Pompeii and Herculaneum are good examples of Romanised urban, civilian settlements that predate the invention of glassblowing and would have held any glass usage traditions that existed in Rome prior to the introduction of the new technology.

6.1.2 Significance of these sites to this Thesis

As briefly suggested above, the sudden destruction of Pompeii and Herculaneum have been a great boon to archaeologists and historians, because they provide opportunities view large numbers of artefacts in their primary use environments rather than just in loss, or discard contexts. For a study of fragile artefacts like glass vessels this is a rare occurrence. Vessels are usually discarded, or collected for recycling after breakage, and whole vessels are generally only found in burials, when catastrophic events have resulted in their loss, or when their owners have been unable to reclaim them. Pompeii and Herculaneum are the only sites in this study that provide a large body of completed vessels in clear usage contexts that are easy to identify. These factors remove uncertainty from vessel identification and allow for more meaningful discussions of usage patterns as the locations of use and loss can be readily identified and there are fewer questions about fragments being residual or having shifted from layer to layer. Pompeii and Herculaneum also provide a range of social contexts in a civilian environment at the heart of the Roman Empire, which will help to illustrate how quickly glassblowing was picked up and how it related to cast glass in the heart of the Roman world where glass production and usage was well established before the invention of glassblowing. The detailed contextual information preserved in these sites also allows for the most detailed use of context, in this thesis, to establish vessel status and allows for the accessibility of cast and blown glass to be evaluated across the social spectrum.

Pompeii and Herculaneum are intriguing sites to study in relation to the glass industry because of the close relations to glass production to the perfume industry, which bottled its goods in small vessels made primarily out of glass (d'Ambrosio 2001: 22-23; Jashemski 1979: 276; Mattingly 1990: 81). Campania is recorded in Pliny's *Natural Histories* (15.8 and 18.111) as a major production region for perfumes and he states that Campania produced more olive oil for perfumes than for all other purposes combined (bathing, lighting and eating). There are several examples of artwork in both Pompeii and Herculaneum that depict cupids at work producing perfumes (d'Ambrosio 2001: 20). Flower sellers are painted along side perfumers in the House of the Vettii (Pompeii, VI.15.1) and in a house near the temple of Apollo (Pompeii, VII.9.13), the latter of which included an image (now lost) of what has been interpreted as an olive press (Della Corte 1954: Nos. 339-340; Mattingly 1990: 72-72; 82). Wedge presses, such as the one depicted in the lost Pompeian painting can be associated with perfumery due to a text from the late-Roman writer Pappos translated in part by A. G. Drachman which says that the wedge is a great service for the perfume industry (Drachman: 1963: 55-56).

The perfume, and related, makeup industries were of great importance in the Roman as these goods were not just for making wealthy ladies look and smell nice. Both makeup and perfumes were used by men,[84] to some extent, as well as women, and

[84] Juvenal's character Crispinus is said to have worn enough perfume for two funerals and Suetonius' biography of the emperor Otho (*Otho* 12) suggests that he wore a wig and used a face pack for his complexion (Stewart 2007:19).

were used to varying extents across the social spectrum[85] (Stewart 2007: 19, 103-107). Perfumes were added to furniture and lamp oil to scent rooms (d'Ambrosio 2001: 22); they were used as medicines, deodorant, breath fresheners, eye salve, and various hygienic practices. Perfumed oils, carried in glass bottles were commonly used in the bathhouses to mix with the dirt and sweat and carry them away when scraped off with a *strigil* (Stewart 2007: 51-57).

In addition to the perfume industry, Campania, and by extension its coastal towns of Pompeii and Herculaneum would have thrived off of cereal crop agriculture. The diet of ancient Romans was largely based on wheat, and olive oil, with an estimated 300 kilograms of wheat required per person per year, supplemented with legumes and other crops. The rough estimate usually given for first-century Rome's population is one million people meaning that Rome required approximately 300 million kilograms of wheat per year, which was far more than could be provided by its immediate surroundings (Hopkins 1983: 84; Kessler and Temin 2007: 315). Rome would have relied heavily on fertile regions like Campania, which was renowned for its quality of grains and had excellent access to sea trade via the Bay of Naples (Rickman 1980: 101-104; White 1970: 65-76), with the rest of Italy, North Africa, and Gaul[86] (Fulford 1987: 67-69). The volume of shipping to bring in the necessary grain would have been incredible[87] and shipwreck evidence proves that ships rarely carried just one cargo, meaning that there were plenty of opportunities for trade in other goods (Fulford 197: 67). Coastal cities like Herculaneum and Pompeii, which connected the Campanian hinterland to the sea were ideal locations to trade the grains along with perfumes,

[85] There is less written evidence for perfume and makeup use among the lower classes than among the elites.
[86] Shipwreck evidence between Gaul and Italy shows a high volume of shipping in the late Republic and early Empire (Parker 1980: 50-51).
[87] Garnsey estimates a required 200 million kilograms of imported grain per year (1983: 118), which would require around 500 shipments of 400,000 kilograms each (Hopkins 1983: 101).

ceramics, glassware, and other sundry items that could have been transported along with the grain as well as prime locations to receive goods brought by the trading ships as they came to collect Campanian goods.

Relatively little has been done on the body of vessel glass at Herculaneum and Pompeii. Discussions of specific vessels appear in discussions on the history of glass, or specific exhibitions, comparisons to other glass assemblages, or commentary on the eruption of Vesuvius (d'Ambrosio 2003; Calvi 1968; De Tommaso 1990; Harden *et al*. 1987; Harden 1969; Pagano 1989; Susan 1976). These assemblages have been used to illustrate the distribution of forms in catalogues such as Isings' (1957) work. Glass has also played a part in the discussion of the cosmetics and perfume industries in these cities (Giordano and Casale 2007; Jashemski 1979; Mattingly 1990), but there has been almost nothing analysing the whole assemblage of either site, except for Scatozza-Höricht's catalogue of the Herculaneum material.

6.1.3 Criteria Examined

The work on Herculaneum examines all the conserved vessels in the Inventory of the Herculaneum excavation. There is an examination of the types of vessels being used, the production types represented, and the locations in which they were discovered. Pompeii will be covered in parallel, but in a more limited fashion due to the constraints of this project, but can provide an excellent study for the use of material over the entire spectrum of Roman urban culture in the centre of the Empire. Thus, Pompeii's study will be limited primarily to the insula of the Menander, which contains a wide range of social contexts and has been published in detail (Allison 2006; De Carolis 2004; Ling 1997).

6.1.4 Methodology

The methodology for recording vessels at Herculaneum was largely the same as that in the three frontier case studies presented in this thesis. The main difference for vessel analysis and recording stemmed from the fact that many of the vessels are preserved entirely, or at least largely intact due to the conditions of the eruption. This factor combined with retention biases of excavators and conservators has resulted in an assemblage made up entirely of unique, countable vessels. Although the same factors that were examined at other sites are recorded for each item number from these sites, it is not necessary to work out which fragments could come from the same vessel and calculate MNI. The whole, or nearly whole vessels could simply be counted.

A further difference between these sites and the earlier ones in this thesis is that the glass vessels from Herculaneum and Pompeii were, to a great extent, preserved in their usage contexts, rather than in loss or discard contexts. The ability to look at complete vessels in their usage contexts allows for an examination of the extent to which glass vessel use had spread through different levels of society, and can show what types of vessels were used at each level. The recording of the assemblage from the open-plan excavations at Herculaneum allow for an examination of which vessels came from which contexts for a whole section of the city. In order to understand the distribution of vessels across levels of society the various find contexts are assigned to categories based upon social classes identified through house features as defined by De Carolis (2004) in a study of Pompeii Region I. De Carolis defined five social classes among Pompeian houses, each with a defining feature in their architecture. The first category is defined as 'rich patrician' homes, which were identified by the presence of a complete peristyle, whereas the second category of 'poorer patrician' homes contained only a partial peristyle. Third was the 'upper middle class,' with homes identified by an *atrium*, garden, or courtyard. Fourth was the 'lower middle class,' defined by private houses, which lacked the features of the first three categories, and the final class was the 'working class,' which included multiple family structures, or combined residential and commercial space (De Carolis 2004: 75-77). Since the Herculaneum excavation includes a broader variety of contexts than Region I of Pompeii, categories must be added for public space and unclear contexts, due to incomplete excavation. It is also useful to divide De Carolis' final category in two, leaving one for purely residential space and one for combined residential and commercial, as both appear in the Herculaneum excavation.

Of course, it is necessary to remember that these social class distinctions are simply being used as a tool, and the identifications of structure and class is theoretical. There is certainly a degree of fluctuation between these classes, which are modern labels. The wealth and class of occupants likely varied over time, and the features of buildings are not definitive markers of patrician or plebeian status. When discussing the status of houses at Herculaneum, Deiss identifies some formerly grand homes as patrician homes that have been renovated and sub-divided for the rising middle class (Deiss 1989: 84). The scale of the commercial middle class may be less prominent in the resort community of Herculaneum than in the busier trading port of Pompeii, which had provided access to both sea trade and trade up river into the hinterland of Campania (Grant 1971: 15-17). The argument for different populations of the middle class is determined by their inability to afford as much space as the upper classes, which would have led them to build upwards rather than on large pieces of land. Therefore, Deis believes that the middle class is represented by multi-storey houses lacking *atria* or *impluvia*, and such houses are relatively rare in Herculaneum (Deiss 1989: 103-105).

The distinction between private and public space can often be blurred. This does not just occur at the lower social levels, where people may have lived in or above their shops. There is also an idea that several of the wealthiest homes functioned as both public and private space. The House of the Atrium Mosaic has a typical residential *atrium*, but where a *triclinium* would be expected, there is a two storey pillared corridor in the style of a basilica, which is far bigger than a simple dining room for entertaining guests, and the House of the Deer has a room with a triangular pediment as one would find on the exterior of a temple or basilica hinting at a quasi public function. (Wallace-Hadrill 1994: 18-19)

At Pompeii, connecting vessels to their find context proved more problematic. The division of its assemblage across multiple storage sites, and the lack of a complete inventory with provenance data for the collection in the National Archaeological Museum of Naples meant that it was not possible to look at all the material from a sample of contexts from around Pompeii and get the same type of social-economic coverage as was possible at Herculaneum. A degree of sampling was possible, however by visiting the collection still stored at the site directory office in the *Casa di Baccho* in Pompeii. Through a catalogue of glass produced by Beretta (2004), it was possible to select a group of items from specific buildings that were stored with provenance data in Pompeii allowing for the identification of which types of vessels were found in a number of contexts. Furthermore, De Carolis' (2004) study allows for a comparison of the quantities of glass, although not specific vessel types, with the quantities of fine ceramics, clay pots, bronze vessels, and silver vessels in five different social contexts within the Insula of the Menander. This data helps to identify the role of glass in Pompeian society and will serve as a comparison against the more complete picture of the Herculaneum assemblage. Since all of the houses in the area studied by De Carolis appear to have been in use, this limited focus helps to avoid the issue that would impact a broad survey of Pompeii, where many homes appear to have been vacant at the time of the eruption (Allison 2004: 192-196).[88] The high vacancy level would mean that the average level of goods would not be representative of other settlements of this size and estimated population density in the Roman Empire.

6.2 Types of Glass Production

The excavations at Herculaneum and Pompeii have turned up glass items in many forms, which were produced through various casting and blowing techniques. The numbers that are presented below show that glassblowing produced the majority of vessels in the current assemblages, indicating that glassblowing was responsible for nearly every glass vessel being used at the time of the eruption of Vesuvius in A.D. 79. This claim can be made with some certainty for two reasons. Firstly, the excavation biases evident at both sites lean strongly toward preservation of the late first-century city, meaning that the glass that has been uncovered hails from that time period and earlier layers along with any preserved glass used in them remain buried. Secondly, the wealth of material discovered in these excavations has been so great, that most fragmentary material that cannot be reconstructed has not been retained. As a result, material from earlier time periods that had fallen out of use due to breakage would not have been retained by the excavators for inclusion in the assemblage available to researchers today.

[88] Much of Pompeii was still undergoing reconstruction from the earthquake of A.D. 62 and many homes were still unoccupied at the time of the eruption (Allison 2004: 192-196).

6.2.1 Cast Glass

While Pompeii and Herculaneum are old sites with long histories that predate glassblowing, casting is not well represented at either one. The numbers appear to indicate that cast vessels did not continue to be used widely for very long after glassblowing was introduced to the region, and the nature of the excavations has prevented any study of the earlier periods. The lack of cast glass persisting into the first century may easily be underrepresented for a number of reasons. The intensive occupations of the sites makes it likely that any broken examples of pre-glassblowing holdovers would have been collected and recycled, and the seismic activity in the region, particularly the devastating earthquake of A.D. 62 could have lead to large-scale breakage of fragile glass vessels. As a result of this event, it is probable that much of the glass assemblages present in the eruption layer was produced and used in the last 17 years of the lives of these cities. Glass casting could have continued to be used well into the middle of the first century only to have much of its evidence destroyed, and that the eruption layer primarily represents patterns of use in the third and early fourth quarters of the first century.

6.2.1.1 Herculaneum

There are very few cast vessels in the assemblage in the archaeological stores in Herculaneum. The sum of all cast vessels in the Herculaneum assemblage is a mere 27 individuals, and every example is an open form. Seventeen, or eighteen of these, depending on the identity of the base fragment 77350, are bowls. The remainder are two *trullae* (saucepan-shaped vessels), four plates of Isings Form 5 (five if 77350 is a plate), two trays, and a cup or *simpulum* (dipper/ladle).

Table 6.1: Types of cast vessels from Herculaneum and their find contexts.

Isings Form	Finds	Number of Vessels	Colour	Context
1: Polychrome hemispherical bowl. (Appendix 1 a)	75752/475	1	*Millefiori*: Blue, white, yellow, and green.	House of the Atrium Mosaic IV, 1-2
	76187/910	1	Dark Blue, with green, yellow, and white mosaic decoration	House of the Double Atrium. VI, 28-29
2: Carinated bowl. (Appendix 1 a)	77349/2068	4	Opaque light blue	House of M.P.P. Granianus Or. I, 1a
3: Pillar-moulded bowl. (Appendix 1 a)	75429/153	1	Dark Blue	House of Gratticus. III, 13-15
	77637/2341	8	Blue-green	Northeast side of the *Decumanus Maximus*
5: Shallow dish or plate on a ring base. (Appendix 1 a)	76195/918	1	Colourless	House of the Double Atrium VI, 28-29
	77350/2069 (Possibly Isings 20)	1	Dark Green	House of M.P.P Granianus. Or. I, 1a
	78093/2796	1	Dark Green	Unknown
	78183/2886	1	Dark Green	Painted room on the upper floor of the new building on the *Decumanus Maximus*
	78227/2930	1	Dark Blue	*Decumanus Maximus*, road surface
17: Bowl with fine ribs and marvered decoration. (Appendix 1 a)	78178/2881	1	Brown, yellow, and white.	First floor gallery of new building on the *Decumanus Maximus*
20: Bowl on a ring base. (Appendix 1 a)	77253/1972	1	Dark Green	House of Apollo the Citharist
75 a: *Trulla* (shallow saucepan) (Appendix 1 a)	77856/2559.3	1	Blue, Green, Yellow, and Colourless	*Decumanus Maximus*
	76187/910	1	Dark Blue	House of the Double Atrium. VI, 28-29

Isings Form	Finds	Number of Vessels	Colour	Context
Miniature table.	77325/2044	1	Opaque Light blue with white core	House of the Double Atrium. VI, 28-29
Simpulum (glass ladle)/cup.	76188/911B	1	Polychrome Blue with White	House of the Double Atrium. VI, 28-29
Tray	77858/2661	1	Peacock blue	*Decumanus Maximus*

One of the *trullae* is a particularly notable piece. It is made of a matrix of colourless glass containing, blue, and green sections, and bands of gold made up of flakes of gold leaf embedded in the glass. It has the depth of a *trulla*, but is identified as another type of dipper by Scatozza-Höricht (1986: 37-38. No. 54). The vessel has two concentric rings on the base and a slight abraded band on the exterior just below the rim. The luxurious design suggests that it may have been quite an expensive piece, but its social context is uncertain as it was found on the surface of the *Decumanus Maximus* where it may have been swept by the volcanic surge, or dropped by a fleeing citizen.

The cast vessels at Herculaneum do not indicate that the primary function of casting was to produce expensive luxury goods. Only around 18 per cent (up to a maximum of 40 per cent) of the cast vessels (5-11 individuals) appear to be particularly unique items. Plates are more widespread at Herculaneum than the other sites, reducing the likelihood of them being luxury wares, and four out of the five are simple monochrome items. The fifth is a possible luxury item judging from its clear, colourless medium combined with its find location in the wealthy upper middle class (by De Carolis' classification) House of the Double Atrium. There are only two polychrome mosaic bowls, and four opaque, light blue, carinated bowls that roughly match Isings Form 2, but nothing other than the fact that they were found in one of the wealthiest homes could indicate that they were of high status. The forms are relatively simple and could have been formed quickly by slumping them over an open mould. The cast *simpulum*, of which the production method is not entirely certain, could be considered a potential luxury item, due to its find context (House of the Double Atrium), its polychrome decoration and due to the fact that it appears to be made differently than most others of its form. The trays have the appearance of luxury goods as they both have striking designs. One is monochrome, but it is cast in an attractive peacock blue glass, and has an oblong shape that terminates in a rectangular platform at one end, and a rounded, almost trefoil spout at the other. The second tray is the most unique glass item at Herculaneum. It is a miniature table cast in opaque light blue glass with narrow legs that terminate in lion's paws. This vessel is the most definite showpiece in the whole assemblage, as it would have had relatively little functionality, but would have required very complex casting and tooling to complete.

In stark contrast to the other sites in this thesis, excluding Pompeii, which is not a full case study, the majority of cast vessels in the assemblage fall into categories other than the pillar-moulded bowl form. In this case, pillar-moulded bowls only represented a third of the cast vessels, and a negligible three per cent of the site's glass vessels. The next lowest representation of this form was at Nijmegen's *vicus Oppidum Batavorum*, where the pillar-moulded bowl represented three quarters of the cast glass and less than nine per cent of the total vessel glass. This form also represented three quarters of the cast glass at the Vetera I fortress at Xanten, but there cast glass represented more than a quarter of the total glass and the pillar-moulded bowl itself represented 21 per cent of the total. The pillar-moulded bowl form appears in decorative polychrome designs that would have required extra, complex production steps other sites, but at Herculaneum none of the nine examples have any evidence for additional production steps or high status. All but one of them are utilitarian blue-green vessels, and the other is a common, dark blue, monochrome bowl. It is possible that this form would have included more examples and that, in spite of their thick walls, they were broken in the eruption and therefore not retained. The pillar-moulded bowl's large open form may make it more susceptible to breakage than smaller forms, in spite of their relative thickness, but their relative durability also makes them break into relatively one of the easier forms to recover and restore, so even if they were broken, they may be more likely to be recovered and retained; especially if they were decorative.

6.2.1.2 Pompeii

This project's limited study of Pompeian glass identified only 12 cast vessels, of which five were pillar-moulded bowls, one was a core-formed unguentarium, one was a plate, and the remainder were other bowls. There was also one cut glass unguent flask. To further complicate this already limited group, only seven of these 12 vessels, including a mere two of the pillar-moulded bowls come from contexts that could be identified more specifically than simply Pompeii. The cast glass that has been identified comes largely from middle-class and higher contexts, but the small sample size is far from definitive proof of status. Simply being found in a relatively high status context does not mean that owners had to be particularly rich to afford it, and the sample is not broad enough to determine the level of cast vessel use in lower class properties. The only find context in which more than one of these examples was found was the *Casa di Lesbianus*, which is a member of De Carolis' lower middle class category with multiple storeys and no atrium or courtyard (De Carolis 2004: 77). Maps of the site reveal that the house abuts an urban vineyard or orchard, so it may have been the house of a food producer, but it is unclear as to whether the open space was accessed through this house or one of the neighbouring properties.

6.2.2 Blown Glass

The quantity of blown glass at Herculaneum vastly outnumbers cast glass, making up nearly all the glass from the eruption period (at least 88.3 per cent). Free-blown glass stands far above any other production technique, being represented by 89.43 per cent of the blown vessels, which is 79 per cent of all glass vessels from the excavations.

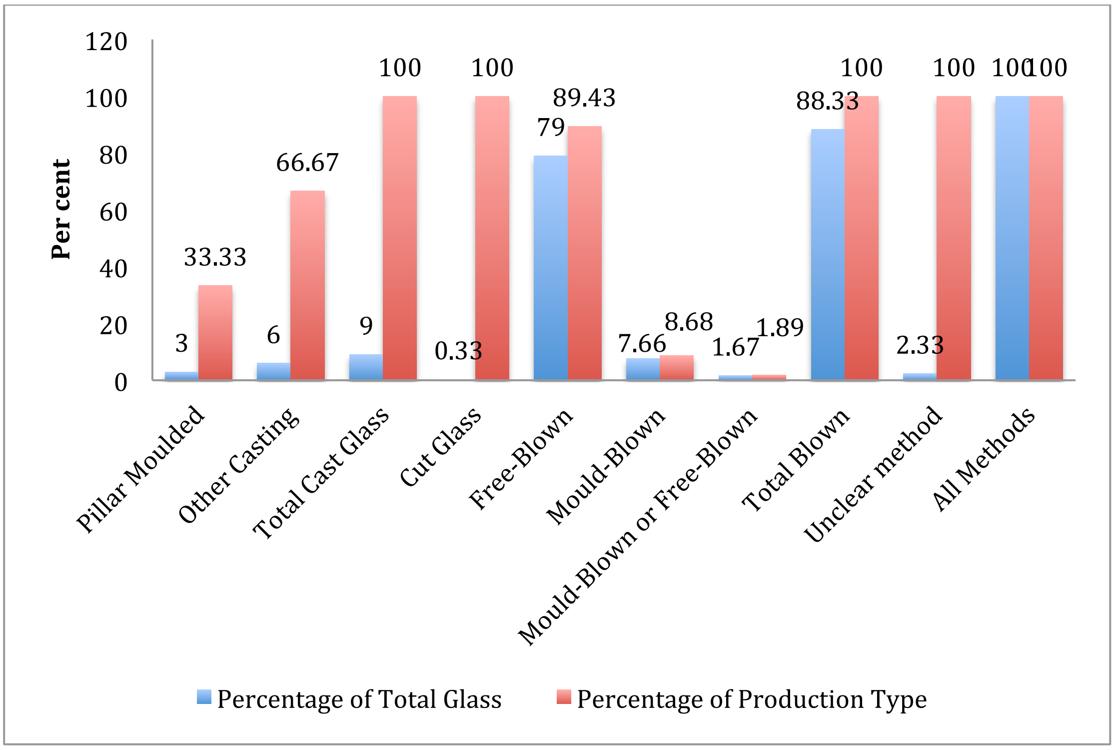

Figure 6.3: Percentage of Herculaneum glass assemblage by production type.

6.2.2.1 Mould-Blown

6.2.2.1.1 Herculaneum

Even including 14 Square Isings Form 50 bottles, which are discussed in the free-blown section below – as is common practice, since they could be produced them through both methods, and the inability to always tell which method was used to produce the fragmentary examples – there are very few mould-blown bottles in the Herculaneum assemblage. Both cast and free-blown vessels outnumber mould-blown vessels, of which there are a total of 23 examples. This number represents a mere 7.66 per cent of the total vessel-glass assemblage and 8.68 per cent of the blown glass.

Only nine of the mould-blown vessels from Herculaneum fall outside of Isings Form 50, and few of these are the decorative tableware that one might expect in a place with such a high concentration of wealthy homes. This fact leads to a number of potential theories. One possibility is that, by the late first century, glass had become common enough that it was not as desirable as a luxurious, statement item, with the rich focusing on decorative silver rather than moulded glass. Alternatively, glass may still be popular, but more for function than style and people could be moving toward simple practical free-blown designs. The possibility of items that are lost from the archaeological record must also be considered. It is possible that some decorative items may have been collected during the various stages of early-modern tunnel excavations without being properly recorded. This could mean that numerous luxurious mould-blown vessels are currently in private collections, or in museum collections without sufficient context data to tie it back to the Herculaneum site, or its specific find location. There are in fact, many items in the National Archaeological Museum that were gathered before Maiuri's systematic open-plan excavations began that are displayed items from Pompeii, Herculaneum, or other Vesuvian sites with no specific context information to tie them to any one location.

Another way that items could have been lost lies in the fine, fragile nature of decorative ware, the violent destruction of Herculaneum, and the spaciousness of high status properties. Fine tableware is often quite thin-walled and fragile, although mould-blown vessels are sometimes slightly thicker and sturdier than their free-blown counterparts. It is highly likely that many of the finest vessels were shattered during the eruption and corresponding seismic tremors. The wide open plans of the homes of social elites could have allowed the volcanic mud to surge into rooms with little hindrance, smashing fragile items. Small fragments do not appear to have been retained, or even recorded by early excavators even if they survived well enough to be found. This kind of destruction and retention bias could explain why so few mould-blown tableware or fine toilet vessels were discovered, relative to thicker durable square bottles. Poorer residences or commercial spaces that have smaller rooms and narrow corridors could potentially have provided better conditions for glass vessel survival by creating barriers for the volcanic surge. This will be considered as distribution and the prominence of production types is discussed further on.

6.2.2.1.2 Pompeii

In the limited study of Pompeii's glass from known contexts there were only 15 mould-blown vessels, two of which are questionable, Isings Form 51 cylindrical bottles that may have been free-blown and marvered. These vessels mainly come from middle to upper class houses, with the two bottles and an anforisk coming from the House of the Lesbian (I,13,9), seven examples of square jars and bottles coming from the House of Julius Polybius (IX,13,1.3), a head-shaped jar from the peristyle of a house in Region XIII, and one jar coming from the House of Menander (I,10,4). If items that lack specific contexts, which were examined in the National Archaeological Museum at Naples are included then the numbers increase to twenty vessels, including another cylindrical bottle, four prismatic bottles (three square and one triangular), an *askos*, and four Isings Form 31 beakers. There are many more examples from Pompeii, but there was no chance to view them all, and there were far greater numbers of free-blown glass vessels that fell outside of the sample, so mould-blown vessels were not unfairly excluded. In fact, they represent a higher proportion of vessels in this sample than the mould-blown vessels of Herculaneum represent of their assemblage. This sample simply gives an idea of some of the forms that were present, and illustrates that they do not differ greatly from the forms at Herculaneum.

6.2.2.2 Free-Blown

Free-blown vessel glass is abundant at Herculaneum. Many different free-blown vessel types and forms are present, and this production type is represented across all of the defined social categories used in this chapter. Examples of the free-blowing technique are found among nearly every category of vessel found in the Herculaneum assemblage. The exceptions being *trullae* and plates or platters, of which all extant examples are cast. There is also one crater listed in the Herculaneum catalogue, which may well have been free-blown, but is listed as destroyed, and was thus unavailable for research and cannot be definitively assigned to a production category.

The forms of blown glass vessels are discussed in ten different categories: Beakers, cups and bowls, jugs, flasks and unguentaria, *aryballoi*, *askoi*, *anforisks*, bottles, jars, and lids. Lids are discussed as a separate form, because they are categorised that way in Isings Form catalogue (1957) and there are no direct connections between the lids present in the assemblage and the type of vessel with which they were used.

6.2.2.2.1 Beakers

The Herculaneum assemblage contains nine free-blown beakers of six different forms. Three examples may not be considered true beakers, as they have single handles, but they are included in this category since they are clearly drinking vessels serving the same function as beakers. Whether a result of the pattern of volcanic damage or of usage is uncertain, but it is notable that all but two of the examples in this category come from contexts along the *Decumanus Maximus*. Beakers are generally very thin-walled, the average of the examples in this assemblage being 0.103 centimetres, so it is understandable if few examples survive in forms that can be reconstructed. They are among the forms most likely to have been smashed by the volcanic surge due to their thin walls and large surface area. While previous chapters have suggested that beakers may have been most popular among higher levels of society, they would among the least likely forms to survive an uninhibited volcanic surge into structures with lots of open space, such as the wealthy homes with *atria* and peristyle courtyards.

Table 6.2: Free-blown beakers from Herculaneum.

Isings Form	Finds	Number of Vessels	Colours	Context
29: Beaker with wheel-cut decoration	76038/761	1	Light Green	House of the Alcove
30: Beaker that narrows toward the mouth.	77650/2354 and 77653/2357	2	Blue-green	Northeastern edge of the *Decumanus Maximus*.
32: Indented beaker.	77648/2352	1	Light green	Northeastern edge of the *Decumanus Maximus*.
34: beaker with a foot and wheel-cut decoration.	77651/2355	1	Blue-green	Northeastern edge of the *Decumanus Maximus*.
35: Indented beaker on a foot.	76527/1249	1	Light Blue	House of the Wooden *Sacellum* V, 31.
37 a: One-handled beaker.	75427/151; 78185/2888; 78213/2916.2	3	Two are light green and one is blue-green.	House of Opus Craticium III, 13-15; House of the Double Gate, upper floor, painted room; House of the Double Gate, first floor mezzanine above shop.

6.2.2.2.2 Cups and Bowls

There is little variety among the 32 bowls at Herculaneum, some of which could be considered to be cups because of their small size. Only four forms are represented. Of these, 26 vessels are confidently identified as bowls, and the vast majority of these

(20 items) are readily identified as Isings Form 20 bowls on a ring base. A further five bowls may also be Isings Form 20, but have features that could allow them to be identified as other forms. One may be Form 41 *b* (bowl with out-splayed sides) or Form 42 (bowl with a horizontal rim and convex walls), another could also be Form 42, and the other three are possibly Form 44, which has a similar form but a tubular rim. There is only one free-blown bowl that is clearly identifiable as a form other than Isings 20 and that is a Form 42 bowl.

Six vessels in the Herculaneum assemblage may be defined as either cups or bowls due to their size four of them are Form 41 *b* and the remaining two are Form 44.

Table 6.3: Free-blown bowls from Herculaneum.

Isings Form	Description	MNI Vessels
20	Bowl on a base ring	20
20 or 41 b or 42		1
20 or 42		1
20 or 44		3
41 b	Cylindrical bowl with out-splayed rim	4
42	Bowl with horizontal rim and convex sides	1
44	Bowl with tubular rim	2

One very notable absence from the cup and bowl category at Herculaneum is the Isings Form 12 cup with horizontal wheel cut decoration. It is one of the most common blown vessel forms at the other western sites in this thesis, but is entirely absent from the assemblage examined at Herculaneum. It is, as yet, unclear if this may have been a form that originated in the western provinces, or if there was simply a preference for drinking out of finer beakers or bowls in Southern Italy. There is one example that appeared in the limited study at Pompeii, however, so while its numbers still appear to have been low, the complete absence of this form may be a result of excavation choices or retention.

6.2.2.2.3 Jugs

There are just five examples of free-blown jugs in the Herculaneum assemblage. This number appears remarkably low for an excavation of this scale containing homes from numerous social classes and several *tavernae*, which might reasonably be expected to contain serving vessels. The low number of jugs likely results from the destructive nature of Herculaneum's end and the fact that blown jugs are relatively large, while also being quite thin-walled. The average wall thickness for the extant examples is 0.14 centimetres. This combination of size and thickness would have led to the destruction of many vessels of this type, and the nature of the excavations and retention policy means that evidence of badly broken examples is lost. The examples here must, therefore, be taken as a sample of jug types that were present, but must be understood to be far from a representative sample of numbers for a city of this size.

The Herculaneum jugs studied fall into only two, or possibly three forms. Four of the five vessels in this category are bulbous jugs of Isings Form 52 *a* (Isings 1957: 69-70), although one of these has quite a short neck, and the majority of Form 52 vessels have a long neck (Isings 1957: 69). The shorter neck makes this jug look like an Isings Form 53 jug (Isings 1957: 71), but in its current broken state there is no evidence of the diagnostic shoulder ridge of that form. The author's identification of all four of the vessels as Isings 52 *a* is supported by Scatozza-Höricht's discussion of the Herculaneum vessels, in which she groups the questionable item 78184/2887 together with the Isings 52 *a* category (Scatozza-Höricht 1986: 50). Scatozza-Höricht counts one of the other Isings 52 *a* jugs as her own Form 28 (Scatozza-Höricht 1986: 49) due to the different folded ring finish on the rim similar to the flask form Isings 70 (Isings 1957: 90), but the rim still meets the criteria for Isings Form 52 as it is still formed by folding the rim out and up, although it is less triangular in profile than most examples.

The only jug of a clearly distinct form is a large oinochoe with a trefoil mouth. This has two possible identifications. The first possible identification could be Isings Form 56 *b*. Form 56 is a long lasting imitation of a popular bronze jug form with pre-Flavian origins. 56 *b* is relatively rare, but it has a longer 'bird's beak spout' (Isings 1957: 74-75). Scatozza-Höricht does not identify this jug as this first-century form, but rather, as an early example of Form 88 *b*, a large jug with a trefoil rim and no base ring, which Isings (Isings 1957: 105; Scatozza-Höricht 1986: 49) identifies as second century. The problem with this identification is that according to Isings, the earliest examples of this form come from the mid-second century, well after the burial of Herculaneum (Isings 1957: 105). Of course, form chronologies could be expanded as our knowledge of Roman glass expands, but there is no reason to distinguish it from a pre-existing form, which also has a trefoil mouth and no base ring. The identification of the oinochoe as Isings Form 88 likely comes from its relatively large size, where many Isings 56 vessels are quite short, but in Isings Form catalogue there is only a difference in height of 1.3 centimetres between the two example form drawings (Isings 1957: 74, 105) and both forms came in a range of sizes.

Table 6.4: Free-blown jugs from Herculaneum.

Isings Form	Inventory Number	Find Context
52 a: Bulbous beaker on a foot. (Appendix 1 c)	75306/30	House of the Skeleton III, 3.
	75433/157	House of Opus Craticium III, 13-15
	76247/970	House of the Wooden *Sacellum*. V, 31.
	78184/2887	House of the Double Gate: Upper floor, painted room.
56: Beaker with trefoil mouth.	77659/2363	North-eastern edge of the *Decumanus Maximus*

6.2.2.2.4 Flasks and Unguentaria

Flasks and unguentaria are being listed in the same section due to the fact that large bulbous or pyriform unguentaria and small flasks are often difficult to distinguish from one another and the actual purpose of these borderline vessels may be unclear. They are, however, divided within the section as much as possible with the features of each vessel. Flasks can be distinguished from some unguentarium forms by their folded, rather than cracked-off rims, and occasionally by wheel-cut decoration. Folded rims are, however, also present on some unguentaria of Isings Forms 26 and 28 (Isings 1957: 40-43). Flasks are identified as distinct from bottles and jugs because they lack handles, although their body and neck shapes and sizes are often quite similar. They are usually, however, smaller than jugs. It is generally unclear if they were used to hold oils and balsams from bathing and toilet activities, or if they were for holding cooking or drinking liquids.

6.2.2.2.4.1 Flasks

There are a total of 29 vessels that can reasonably be identified as flasks, in the Herculaneum assemblage. These all fit into four form categories: Isings 16, 70, 71, and 72 (Isings 1957: 34-35, 90-91), and are dispersed across a variety of social contexts, none of which are bath houses, or the *palaestra*, suggesting that they were not primarily being used for toilet and bathing practices. Isings Form 16 is the most common form of flask with 23 examples among the Herculaneum assemblage. This type is pyriform with a folded, usually triangular, rim and often has horizontal, wheel-cut decoration. It is the kind of flask that can have the thickest walls, and the sort of neck and rim that is most easily confused with jugs and storage bottles.

6.2.2.2.4.2 Unguentaria

Unguentaria are the most common types of vessels surviving at Herculaneum. Out of all 300 vessels recorded and stored in the excavation collection, 119 fit into this category (Table 6.5), with three further possible examples, if some destroyed or missing vessels that cannot definitively be labelled as free-blown are included, making up nearly 30 per cent of the glass assemblage (Fig. 6.4).[89] Their small size, often with relatively thick walls and tubular shapes, made them remarkably durable, so in addition to most likely having wide-spread use and being among the more common vessel types, they had an advantage in surviving the eruption largely intact and in easily identifiable conditions. This highly durable 'test-tube' form, Isings Form 8 (Isings 1957: 24-25), makes up nearly half of all the unguentaria, with a total of 50 examples (Fig. 6.5). The number rises to 69 if Isings Form 27 (Isings 1957: 47), which is described as a variation of Form 8 lacking a constriction, is included.

Table 6.5: Free-blown unguentaria and perfume bottles from Herculaneum.

Isings Form	Description	Number of Vessels
6 (Appendix 1.C)	Small bulbous unguentarium with tubular neck	8 (of these, 1 could be I 26 and 2 could be considered 82b, but are better suited to 6
8: Tubular unguentarium with constriction (Appendix 1.C)	Tubular unguentaria with constricted body	50
11: (Appendix 1.C)	Bird shaped	1
26: (Appendix 1.C)	Plain unguentarium, pyriform or bulbous, some have ribs.	11
27: (Appendix 1.C)	Test tube unguentaria with no constriction	19 (Some are hard to distinguish from form 8 and could be either.
28 a and 28 b: (Appendix 1.C)	Pyriform unguentaria with constriction around base of neck.	26
68: (Appendix 1.C)	Bulbous ointment jar	3
82 a1: (Appendix 1.C)	Candlestick unguentarium	1

The remaining unguentaria are divided among six different forms, three of which have multiple sub-categories represented. Form 28 (Isings 1957: 41-43) is a

[89] This includes all forms identified as unguentaria by Isings (1957). Siano's catalogue (unpublished) identifies pyriform types as '*balsamari*' rather than 'unguentaria,' a term which is also applied to smaller flasks.

prominent form, with 26 examples. It is a pyriform style with relatively thin walls, but its small size allows its curvature to give it strength to survive. This form also can be divided into 28 *a* and 28 *b*, based on the percentage of the vessel that is the body. Six of the Form 28 unguentaria were type *b*, in which the body is only a third of the total height, and the remainder are type *a*, in which the body is around half the height.

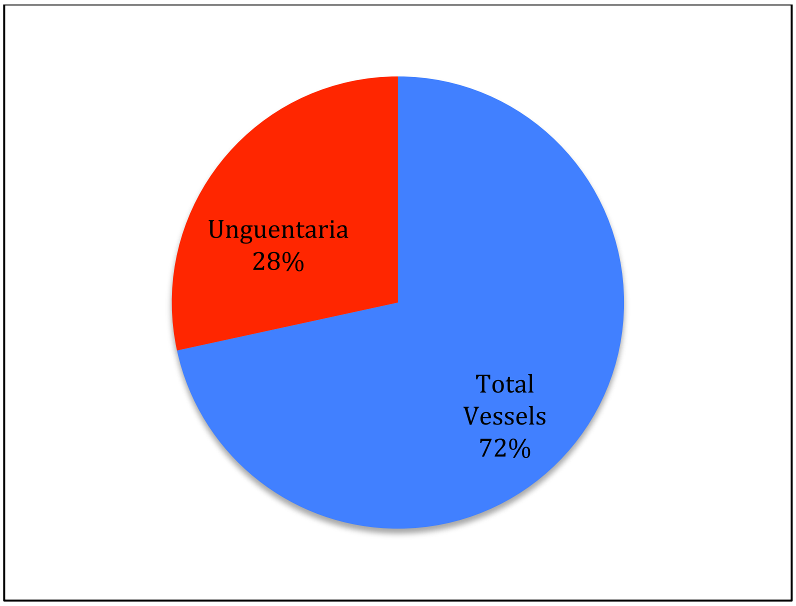

Figure 6.4: Percentage of free-blown unguentaria in the Herculaneum assemblage.

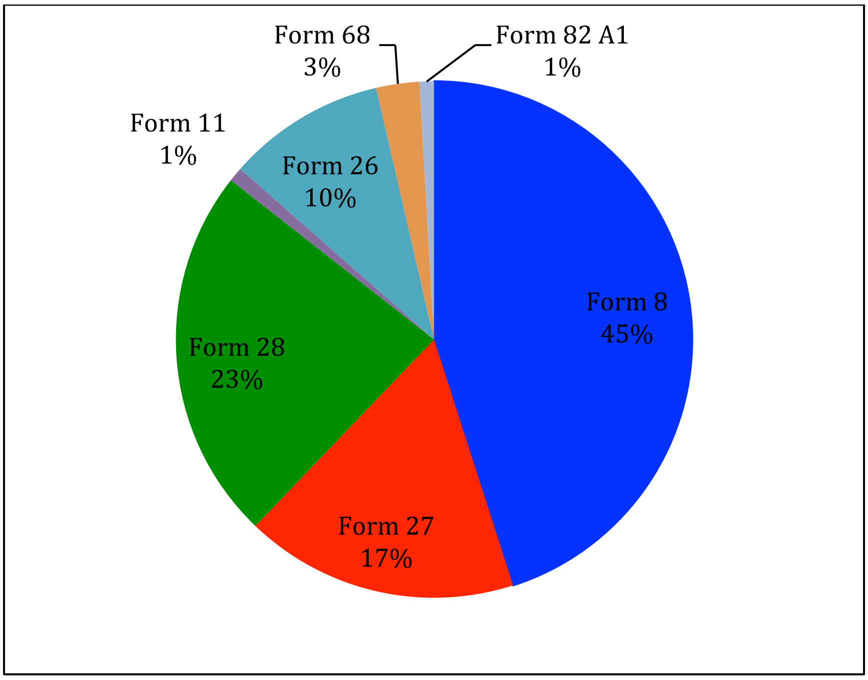

Figure 6.5: Form division of free-blown unguentaria forms from Herculaneum.

The most decorative form of unguentaria in this assemblage is the Isings Form 11 bird-shaped container. These vessels were produced specifically for the contents they held and were finished by heat-sealing the tail after they had been filled. The tails, beaks or wing tips would then be snapped off to access the contents[90] (d'Ambrosio 2001:23). Only one example of this very delicate, thin-walled form survives from Herculaneum, although they were quite popular in the first century, and were likely, due to their fragility, more widely used than remains can show. That said, it is not an ordinary utilitarian item that would be expected across the social spectrum. In fact, in this case, it was found in the fairly wealthy context of the House of the Bicentenary, which according De Carolis' (2004: 76) categorisation would be a patrician house of the second highest classification in the spectrum.

The single example of Isings Form 82 A(1) is worth mentioning if only for the fact that Isings (1957: 97-99) had recorded this sort of 'candlestick unguentarium with a bell-shaped body and long neck as a second-century form developed in the East. This example serves to illustrate that many form chronologies of Roman glass are incomplete, and new finds may expand timelines rather than fit into them. Isings (1957: 98) does allow that the variant 82 A(2), which is one of the most common second century unguentarium forms and is quite similar to this example has often been found in contexts that are not securely dated and may have originated in the late first century. The Herculaneum find could indicate the same thing for variant A(1).

The remaining forms are simple and utilitarian and can be found spread across De Carolis' categories. The levels of representation follow the general trend of free-blown glass quite closely, with the highest numbers of unguentaria in the same social classes as high numbers of free-blown glass in general, also following the rough pattern

[90] Purpose-made heat-sealed perfume vessels were not limited to birds. They often imitated *pecten* shells, and there are amber, *terra cotta* and silver varieties. All 12 known silver examples come from Boscoreale (Giordano and Casale 2007: 22)

of the number of houses in each category (Table 6.6). It is also notable that they make up seven of the nine free-blown vessels from the richest patrician homes, when their durability has been noted along with the hypothesis that the open spaces might have allowed the volcanic surge to rush in rapidly and break other, finer examples of glassware. Knowing that fragmentary glass was not retained for this assemblage this may help to support the reason for the apparent lack of glass in the highest levels of Herculaneum society.

Table 6.6: Distribution of free-blown glass and unguentaria by social level at Herculaneum.

Wealth Level	Number of Buildings	Free-Blown Glass	Free-Blown Unguentaria
"Rich" Patrician	9	9	7
"Poor" Patrician	8	15	4
Upper Middle Class (or low patrician)	16	51	29
Lower Middle Class	2	9	1
Lower Class	1	22	9
Poor Residences and commercial space	29	65	31
Public space	11	48	21
Unknown Context	2	23	17
Totals	–	242	119

Men as well as women used perfumes and oils in the Roman world, so unguentaria would have been required by members of both sexes, and they were used not just as luxurious scents for social occasions, but as ordinary deodorants and as remedies for day to day issues like bad breath, inflammation, skin irritation, ear wax build-up (Stewart 2007: 19, 55-57). The prominence of unguentaria across all levels of society in Herculaneum shows that perfumes were not just something used by the rich, but were common among the urban poor as well (Stewart 2007: 117).

6.2.2.2.5 Aryballoi

Aryballoi, while similar to unguentaria in function as containers for bathing oils, have a distinct readily recognised form (Isings 1957: 78-81, Form 61). They have bulbous, thick-walled bodies, and short necks with folded over loop, or 'dolphin' handles that run along the top of the shoulder, up the neck and then folds back over to the shoulder. These were often fitted with bronze stoppers attached to the handles with a triple chain that could also be used to hang the vessel from the wrist when going to the baths (Isings 1957: 78).[91] Several examples from numerous sites, including Herculaneum, still have remnants of the chain and stopper.

The Aryballos form is based on bronze and ceramic examples and core-formed versions of it also exist, but the blown version found in the Herculaneum assemblage dates to the first century with the earliest datable example known to Isings coming from a Claudian grave at Carnutum (Isings 1957: 79). This form is widely used in the Flavian period and later, with several variations with ring bases and coil decoration developing (Isings 1957: 79-81), but at Herculaneum all nine examples are of the simple, smooth walled bulbous form that would not have been meant for a display of wealth and would have been priced on the value of its contents rather than on the value of the plain, simple to produce vessel.

6.2.2.2.6 Askoi

There is only one example of a glass imitation of the Greek ceramic and bronze (Isings 1957: 79) *askos* form in the assemblage at the Herculaneum site, but it may not have been quite so uncommon as this number makes it appear. There are at least four known examples from Pompeii in the National Archaeological Museum in Naples, and their elegant decorative style could easily have made them prized items for private collections gathered, without proper recording, during early tunnel excavations. The examples from Pompeii include vessels with marvered blob decoration, polished

[91] Isings cites an image in the Vatican museum (Amelung 2, No. 421) and one from the Berlin Altes Museum (II, 1, A 7) as evidence for how it was carried.

handles with spiral patterns, and bulging oval feather-like patterns around the lower body. The Herculaneum example, by comparison is rather plain, with only a trefoil mouth, a central groove on the handle, and pinched folds at either end of the handle for decoration. Isings (1957: 77) has proposed that this undecorated style that is also seen on some of the Pompeian examples may be a local production type, which may suggest that both the Herculaneum and Pompeii examples have the same origins.

6.2.2.2.7 Anforiskoi/Anforettae

As amphorae were used as large transport and storage vessels, a delicate medium like glass was not well suited to the role. Glass was, however, well suited to storing and serving smaller amounts of the same types of contents in settings that required display more than long distance travel. As a result, glass appears to have been used quite regularly for smaller *anforiskoi*.

There are five surviving examples of glass *anforiskoi* from Herculaneum. Three are from houses and two are from shops, at least one of which contained habitation space as well. The Herculaneum examples come in two varieties. Only one vessel matches the relatively common first-century Isings Form 15, which has a base ring. This example has a simple everted fire rounded rim, most of which is now missing. The Isings Form 15 *anforetta* from Herculaneum is different from most vessels of this form in that it earns its classification through shape more than function. It stands a mere 6.6 centimetres tall with a 2.5 centimetre base diameter, so it would not have functioned as a serving vessel or storage container for large volumes of liquid. This specific example was likely either an unguentarium or a decorative item that simply imitated the form of a larger vessel and illustrated the class of its owner.[92]

[92] The miniature anforetta was found in the wealthy middle-class, house of the Bronze Herm (III, 16) (Siano Unpublished).

The second variety of anforisk, found at Herculaneum, is identified by its pointed base, and the examples range in preserved height from 8.36 centimetres to approximately 30 centimetres. This vessel and one other small example may have served more as prestige vessels imitating a larger form than as actual *anforiskoi*. The 9.5 centimetre vessel is the shape of a bag amphora, but the remains of a single handle attachment on the portion of rim that is preserved suggest that this one either had a floating handle that did not attach to the body, or had a horizontal handle, which came back to the rim, rather than a standard vertical amphora handle. Item 76297 is in fact catalogued as a '*coppa*' since no handles are preserved, but it has the globular body and pointed base of an *anforetta*. Unlike the more utilitarian ceramic storage vessels that it appears to imitate, this one has pinched vertical rib decoration.

6.2.2.2.8 Bottles

There are 24 examples of bottles at Herculaneum fitting into three categories, and only 10 cannot definitively be listed as mould-blown. These categories are Isings Form 50, square bottles; Isings Form 51, cylindrical bottles; and one example of a bottle with a lenticular body like a curling rock (Scatozza-Höricht 1986: 57, Form 44). The bottles at in this assemblage are mostly of the squat variety at the shorter end of form range. The short, squat form provides great durability, which could impact survival, both during transportation, and during the eruption. In fact, some examples of Isings Form 50 have been found packed with straw in crates, ready for transportation in the Casa del Menandro at Pompeii (Maiuri 1933 (2): 458, Fig. 81 f.). Square and cylindrical bottles of forms 50 and 51 are generally undecorated, except for the odd manufacture's mark, or concentric ring pattern on the base and grooves on the handles, and they were evidently used at all levels of society. At Herculaneum, they are present in every level of housing from the richest patrician homes, including The House of the Relief of

Telephus, to the multiple-occupancy, lower-class House of *Opus Craticium*. They are also found in public spaces in the *Area Sacra* and in shops.

The unique lenticular bottle, or large flask (it lacks handles), is an incredibly rare form, which is almost non-existent outside of Herculaneum. It slightly resembles some vessels with a taller cylindrical neck from Aquileia (Calvi 1968: 33 and 44, Table A 14F; Scatozza-Höricht 1986: 57; Susan 1976: 212, n. 408). There is also a similar form with looped handles at Stabia, another Vesuvian site (Scatozza-Höricht 1986: 57), but it was rare enough to be overlooked in Isings (1957) catalogue.

6.2.2.2.9 Jars

Most of the jars from Herculaneum are similar in appearance, but there are enough differences to identify a few different forms. Three forms are represented by the six free-blown jars in the assemblage, and just a single individual represents one of those forms. This individual is a member of a form of jug that has a bulbous body and two 'M' shaped handles rising from the shoulder up to the rim. Isings claims that this form was the most common form of handled jar from its inception in the mid-first century A.D. through the second century (Isings 1957: 81-82, Form 63). The second form of jug found at Herculaneum is Isings Form 67 *a*: a handle-less bulbous jar with a flat horizontal rim, of which there are two examples. This form is thought to have served as a household storage jar, having been found in such a context at Pompeii, and Boscoreale, in addition to one of the Herculaneum examples from the House of the Wooden *Sacellum*. This form is most frequently found, however, in secondary use as a funerary urn, which has helped to date this form to at least the Claudian-Neronian period, from which the earliest example of this form[93] hails (Harden 305, No. 90; Isings 1957: 86-87). The third form, represented by one jar from the House of the Wooden

[93] The earliest known Form 67a jug was found in Colchester, England Isings 1957: 86-87).

Sacellum and two from the *Pistrinum* (Or. II, 1-3), is Isings Form 62. This is a square jar with a folded, collar rim. Such square jars appear to have become popular in the Flavian period and are found in abundance at the Vesuvian sites (Isings 1957: 81). This form can be produced through mould-blowing, or free-blowing and marvering. It is readily identified when found whole or with a rim present. But if found in a fragmentary state with only wall or base fragments, it can easily be mistaken for a square bottle of Isings Form 50.[94]

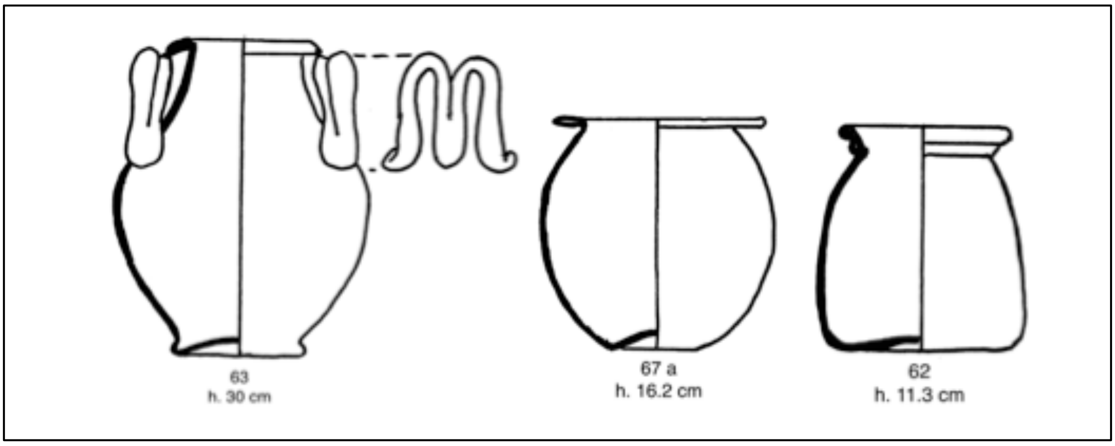

Figure 6.6: Jar types found at Herculaneum.

6.2.2.2.10 Simpula/ Dippers

A form that appears at Herculaneum and Pompeii, but not at any of the other sites in this thesis is the glass *simpulum*. This is a ladle or small cup with a tall vertical handle. Scatozza-Horicht (1986: 38-39) divides these into two forms: One with an everted rim (Form 17) and one with a tubular rim (Form 18). Aside from the rim difference the forms are virtually the same, with shallow, often asymmetrical tubs and a vertical handle rising from the rim. The handles sometimes bend backwards at the top forming a hook as on a ladle handle, and the some examples have trailed, spiralling ribs around the body, but the general form remains the same. One was found in the House of

[94] Isings says that the square jar can sometimes be reconstructed by wall fragments with thin walls, but she correctly points out that there are many examples of square bottles with thin walls, and this is not a clear enough indicator of form (Isings 1957: 81).

the Double Atrium, one was found in either the House of the Gem or the House of M.P.P. Granianus,[95] but all the remaining examples, including every example with trailed decoration were found packed for transport in a shop on the north-eastern edge of the *Decumanus Maximus* (Scatozza-Höricht 1986: 38). There is no evidence noted for glass production tools or a furnace, so this may have been a retail environment.

One other vessel is included in this section, although it is not, actually a *Simpulum*. A dipper with a horizontal handle (75351/75), much like a fairly common type of bronze bath dipper, was recovered from the House of *Opus Craticium* (Siano Unpublished).

6.2.2.2.11 Lids

Although they are not, strictly speaking, vessels, the three lids of the Herculaneum assemblage are included in their own category, because there is no evidence for the vessels to which they actually belonged. Since there is no vessel associated with them that would lead to double counting the lids themselves are counted toward the total vessel count. Lids may well have outlasted their vessels, as several of them belonged to large vessels that would have been susceptible to breakage, and the lids themselves are thick solid pieces of glass. There are only three positive examples of lids all matching Isings Form 66 *b*, with the possibility of one being 66 *d* (Isings 1957: 85-86). A fourth example bears a close resemblance to a small lid of Form 66 *a*, but it could also be the stem and base of a small chalice or incense burner. It was initially published as a chalice, and as glass paste rather than pure glass, but a chipped spot on the edge reveals it to be glass all the way through (Scatozza Höricht 1986: 37 n.51).

[95] The same number is recorded alternatively in each house in Scatozza-Höricht's glass report, and Siano's catalogue of finds.

6.2.3 Pompeii

The assemblage from Pompeii is more varied than that of Herculaneum owing to the scale and variety of contexts within the city and the fact that nearly the entire city has been uncovered, as opposed to just a small portion. This section is, therefore, limited to a collection of 104[96] vessels with readily identifiable contexts that could to be located and examined (Table 6.7). The vast majority of surviving vessels are unguentaria, not unlike the Herculaneum assemblage, which again might be a result of their size protecting them during the eruption, where larger vessels would shatter more easily. The other forms are also not unlike the forms present at Herculaneum.

Table 6.7: Selection of free-blown vessels from known Pompeian contexts.

Isings Form	Description	Number of Vessels	Context
2	Carinated bowl	2	Lower middle-class: Casa di Lesbianus (I,13,9). Working class: Hospitium (I,14,9)
6	Unguentarium	3	Upper middle-class: House of the four columned atrium (I,8,17)
8	Test tube unguentarium	13	Upper middle-class: House of the four columned atrium (I,8,17). Lower middle-class: Casa di Lesbianus (I,13,9). Working Class, Hospitium (I,14,9)
11	Test tube unguentarium with no constriction	1	Upper middle-class House I,11,5.6
12	Hemispherical up with wheel cut decoration	1	Lower middle-class: Casa di Lesbianus (I,13,9).
15	Amphorisk with ring base	1	Lower middle-class: Casa di Lesbianus (I,13,9).
16	Flask	1	Kitchen at the back of a shop, Region V
28	Unguentaria	2	Rich patrician: House of Menander (I,10,4). Workshop with central atrium (I,9,8)
28a	Unguentaria with bodies half their height	9	Upper middle-class: House of the four columned atrium (I,8,17). Lower middle-class: Casa di Lesbianus (I,13,9). Working Class, Hospitium (I,14,9). Workshop with central atrium (I,9,8)
28b	Unguentaria with bodies one third of their height	23	Rich patrician: House of Menander (I,10,4). Upper middle-class: House of the four columned atrium (I,8,17). Lower middle-class: Casa di Lesbianus (I,13,9). Workshop with central atrium (I,9,8).
30	Beaker narrowing toward the rim	1	Shop (I,11,3).
35	Indented beaker on a base	1	Working class rental space (II,3,2) linked to the atrium of the Lower Patrician House of Venus in a shell (II,3,3).

[96] More vessels from publications will be discussed when speaking about distribution below, but for the purpose of this section only the vessels examined by the author are being included.

Isings Form	Description	Number of Vessels	Context
37	One handled cup with fold in the body just below the rim	1	Lower middle-class: Casa di Lesbianus (I,13,9).
37b	One handled cup	1	Rich patrician: House of Menander (I,10,4).
38c	Two handled cantharos	1	Lower middle-class: Casa di Lesbianus (I,13,9).
41a	Cylindrical bowl with straight sides	1	Lower middle-class: Casa di Lesbianus (I,13,9).
41b	Bowl with outsplayed sides	3	Lower middle-class: Casa di Lesbianus (I,13,9).
42	Bowl with base ring	5	Upper middle-class: House of the four columned atrium (I,8,17). Lower middle-class: Casa di Lesbianus (I,13,9). Working Class: Hospitium (I,14,9).
42a	Bowl with horizontal rim and base ring	2	Rich patrician: House of Menander (I,10,4). Upper middle-class: House of the four columned atrium (I,8,17).
44a	Deep bowl	2	Rich patrician: House of Menander (I,10,4).
45	Shallow bowl/plate	2	Lower middle-class: Casa di Lesbianus (I,13,9).
46a	Dish without base ring	1	Lower middle-class: Casa di Lesbianus (I,13,9).
50	Square bottle	1	Shop (I,14,11.15)
50 or 52	Square bottle or bulbous jug	1	Upper middle-class: House of the four columned atrium (I,8,17).
51	Cylindrical bottle	4	Upper middle class: House of Ceres (I,9,13). House of Lollius Synhodus (I,11,5). Unnamed house (I,16.3). Shop (II,1,3).
52a	Bulbous jug	1	Lower middle-class: Casa di Lesbianus (I,13,9).
55b	Conical jug with cut-out base ring	1	Unknown class: (I,18,5)
56b	Spouted jug	1	Lower middle-class: Casa di Lesbianus (I,13,9).
57	Bulbous, almost neckless jug	3	Upper middle-class: House of the four columned atrium (I,8,17). Shop (I,11,3).
59	Askos	1	Upper middle-class: House of Lollius Synhodus (I,11,5.8)
60	Anforetta	1	Rich patrician: House of Julius Polybius (IX,13,1.3)
61	Aryballos	1	Unknown house type: (VI,14).
67a	Ovoid jar with flattened horizontal rim	2	Lower middle-class: Casa di Lesbianus (I,13,9).
67b	Ovoid jar with vertical rim	1	Rich patrician: House of Menander (I,10,4).
68	Ointment jar	1	
74	Funnel	1	Upper middle-class: House of Venus in a bikini (I,11,7).
Krater	Krater	1	Working class: Hospitium (I,14,9)
Jug	Jug of uncertain form	2	Combined house and shop (I,14,11.5). Shop linked to wealthy home (I,10,17)

The ratio of production types at Pompeii, from this small random sample, appears quite similar to the ratios of production types at Herculaneum. The percentage of mould-blown and free-blown vessels are slightly higher at Pompeii, and the percentage of cast vessels is slightly lower (Table 6.8), but for a random sample, there is not enough evidence to say that actual usage ratios across the cities would have been much different. Additionally, as at Herculaneum, different production types are found across the social spectrum, with no one class favouring any production type more than the other classes.

Table 6.8: Percentages of vessels of known production types from Pompeii and Herculaneum.

Production Type	Pompeii (%)	Herculaneum (%)
Cast	5	9
Mould-blown	12	8
Free-blown	82	79
Cut	0	0

6.3 Patterns

Herculaneum is the first site examined at which tableware has not outnumbered both toilet items and storage items. Tableware only makes up 107 of the 300 vessels, or 35.7 per cent. Storage containers such as bottles and jars only make up ten per cent of the assemblage, but possible toilet items make up 53.3 per cent of the assemblage. These counts omit the three to four lids, which have no vessels to match, but which could fall into either storage or tableware categories. There can only be speculation as to why Herculaneum stands out from the previously studied sites in this way, but a few possibilities spring to mind. Firstly, there may have been higher than average numbers of bathing and toilet items in use in Herculaneum due to the wealthier urban environment, and the concentration of baths. The other two potential explanations suggest that there are fewer than average tableware items in the assemblage rather than an abundance of unguentaria. This could either be because ceramics and metal vessels were favoured in the social contexts of Herculaneum, which will be examined in more detail below, or that the tableware items were more susceptible to destruction in the volcanic surge than small unguentaria thus skewing the proportions when complete vessels were counted.

There is a very clear preference for blown glass indicated by the assemblages studied at Herculaneum and Pompeii, despite the fragility of blown vessels relative to cast vessels. Positively identified cast glass represents fewer than ten per cent of the assemblage at both sites.[97] Despite the low numbers, there is little evidence for casting being used to produce more costly luxury vessels than glassblowing. All of the serving vessels, most of the vessels associated with bathing and toilet practices, and the majority of tableware, including fine, decorative examples, were blown. This appears to suggest that the urban populations at the heart of the Empire were whole-heartedly adopting the new technology by the late first century for both decorative and utilitarian roles, and that while cast glass numbers were small, it was not in decline due to its cost and high-status.

6.4 Distribution

While there have been brief comments on the distribution of Herculaneum's vessel glass in the sections above, it is necessary to take a closer look at how the different production types are represented across the city's social levels if one is to understand the role of glass in Roman society, and the roles of different production techniques in making glass vessels affordable and accessible. As much as objects are important to determining what Roman society considered luxury, and what the social status of a context was (Wallace-Hadrill 1990: 187), the context and the structure of a building could also be of value in determining the status of the objects within. This section will therefore use the social status of the find locations to understand the significance and status of some of the glass finds in Roman cities.

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[97] Pompeii: Cast glass = 5 %; Blown glass > 94 %. Herculaneum Cast Glass = 9 % (reaching 11.67 % if the cut vessel and the seven vessels of uncertain production method are counted); Blown glass: 88.33-90.66 %.

Looking at the distribution of cast glass, in the open excavated part of Herculaneum, there is not a huge variation between different social contexts. When applying the social context categories laid out by De Carolis (2004)[98] to the Herculaneum site, adding categories for public space and uncertain context, and then counting the vessels in each category, the results suggest that cast glass was not exclusive to the higher social-economic levels of Herculaneum's population. There may still be a limited trend towards more cast items in wealthier contexts, but the sample size is too small to be reliable. Only one vessel, an Isings Form 1 mosaic bowl, from comes from the wealthiest category of house (the House of the Mosaic Atrium) but a further 11 cast vessels come from houses in the next two categories, which are relatively hard to distinguish from one another at Herculaneum. The lower-middle class, and working class areas only account for three vessels (two ribbed bowls and a plate), there is one vessel of unknown context, and there are 11 cast vessels, 12 if the lone cut vessel from Herculaneum is included, that come from public spaces, which could indicate use by any social class. As a result, less than 50 per cent of the cast vessels at Herculaneum can be assigned to the upper classes by context (Table 6.1), let alone by the forms discussed above (Section 6.2.1.1), meaning that this production form did not carry on strictly for the production of expensive luxury wares. Nonetheless, there is not enough material present to confirm that casting techniques were spreading glass usage widely among people of average wealth.

Mould-blown glass was found in a fairly limited cross-section of society at the Herculaneum site (Fig. 6.7). Seven vessels come from contexts that could be defined public space, although none of them come from typical public structures like a temple,

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[98] De Carolis' categories defined by building features: Rich Patrician, Poor Patrician, Upper-middle Class, Lower-Middle Class, Lower Class, and Mixed Residential and Commercial.

basilica, public bath, or theatre (Table 6.9, Fig. 6.8). The remaining sixteen are from De Carolis' middle-class to lower patrician categories.

Figure 6.7: Mould-blown vessel distribution at Herculaneum (After Grant 1971).

Six of the public examples from public contexts were found on the Decumanus Maximus and may be from buildings along its path (Siano forthcoming). Their find context simply does not allow them to be assigned to a specific building and social status. The one other mould-blown vessel listed as being from a public space comes from the shoreline area in 'boathouse' 12 (Siano forthcoming). This structure is tentatively labelled as public due to the evidence of many people taking shelter there, but there is no clear evidence of either public or private ownership. Even the identification of all 12 rooms as boathouses is not certain. The mould-blown vessels found in 'public contexts' include two bottles, two beakers, one small cup or bowl and two small ointment flasks: one in the shape of a head, and one in the shape of a date.

Table 6.9: Mould-blown vessels found in public spaces at Herculaneum.

Isings Form	Description	Number of Finds	Find context
50: Square bottle (Appendix 1 b)	Squat square bottomed	2	One in a boathouse and one at the North-eastern edge of the Decumanus Maximus
17: Fine-ribbed bowl with marvered decoration (Appendix 1 b)	Ribbed bowl with white marvered lines over moulded ribs	1	North-eastern edge of the Decumanus Maximus
31: Mould-blown beaker (Appendix 1 b)	Raised floral decorations	1	North-eastern edge of the Decumanus Maximus
32: Indented Beaker. (Appendix 1 b)	Regular large oval indents around the body.	1	North-eastern edge of the Decumanus Maximus
78 a: Head Jar (Appendix 1 b)	Unguent jar shaped like an African head.	1	North-eastern edge of the Decumanus Maximus
78 d: Date Jar. (Appendix 1 b)	Unguent bottle shaped like a date.	1	North-eastern edge of the Decumanus Maximus

The mould-blown vessels from middle-class houses are almost exclusively from the upper-middle atrium style house: House of the Wooden Altar (V, 31), House of the Stofa (IV, 19-20), and the Samnite House (V, 1-2). There is an example of an Isings Form 50 bottle from the House of the Double Gate at the Northern edge of the Decumanus Maximus, but due to incomplete excavation, the status of the house is unclear and it has been placed, with reservations, in lower-middle class. The house is multi story and has painted upper floor rooms, but as most of the house is still beneath the modern city, there is no clear evidence of an atrium, garden, courtyard, or even a peristyle, which could move it into the top social categories. Despite being found in these relatively high status homes, the mould-blown vessels are not particularly luxurious or decorative designs. Isings Form 50 bottles make up 14 of these vessels, there is a square storage jar, a conical jug, a ribbed flask, and the only decorative example is a small hexagonal ointment bottle (Isings Form 78) with a face on each side from the House of the Wooden Altar.

Every example of a mould-blown vessel from the 'patrician' contexts comes from the lower-patrician House of the Wooden Partition (III, 4-14). None of these is particularly decorative, with four being Isings Form 50 bottles, and the remaining one being a small, natural blue-green, ribbed flask.

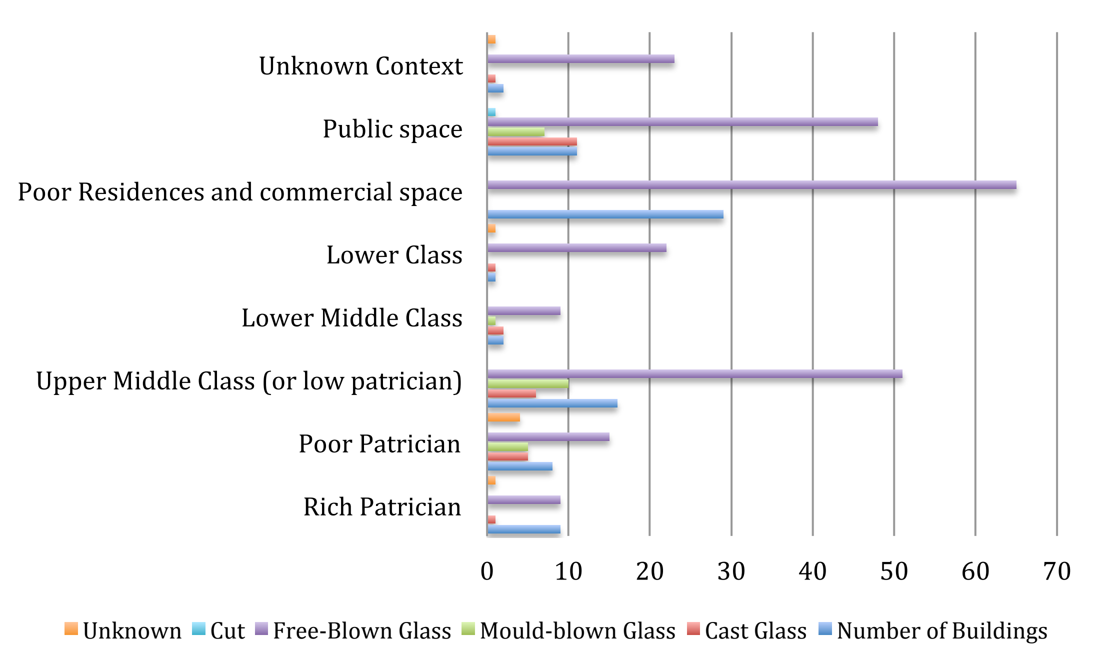


Figure 6.8: Number of glass vessels of each production type by social context at Herculaneum.

In Pompeii, free-blown vessels are represented well above other types in all social categories (Table 6.10). It is also possible to see, by comparing the free-blown glass trend line to see that it follows a very similar pattern as the number of contexts in each category, with a similar gap between the number of vessels and number of locations in most of these contexts. Notable exceptions are in the rich patrician category where the number of houses and number of vessels is almost identical, in the lower middle class category where glass vessel numbers are on the rise while house numbers are low, and in public spaces, of which there are few examples, but glass numbers remain high (Table 6.10, Fig 6.9).

Table 6.10: Distribution of glass in the Insula of the Menander at Pompeii.

Wealth Level	Number of Buildings	Cast Glass	Mould-Blown Glass	Free-Blown Glass	Cut Glass	Unknown
Rich Patrician: Houses With Full Peristyle	9	1	0	9	0	1
Poor Patrician: Houses With Incomplete Peristyle	8	5	5	15	0	4
Upper Middle Class (or Low Patrician): Houses With Atria Or Courtyards	16	6	10	51	0	0
Lower Middle Class: Private Houses With No Atria Or Courtyards	2	2	1	9	0	0
Lower Class: Multiple Family Houses	1	1	0	22	0	1
Poor Residences And Commercial Space	29	0	0	65	0	0
Public Space	11	11	7	48	1	0
Unknown Context	2	1	0	23	0	1
Totals	**76**	**27**	**23**	**242**	**1**	**7**

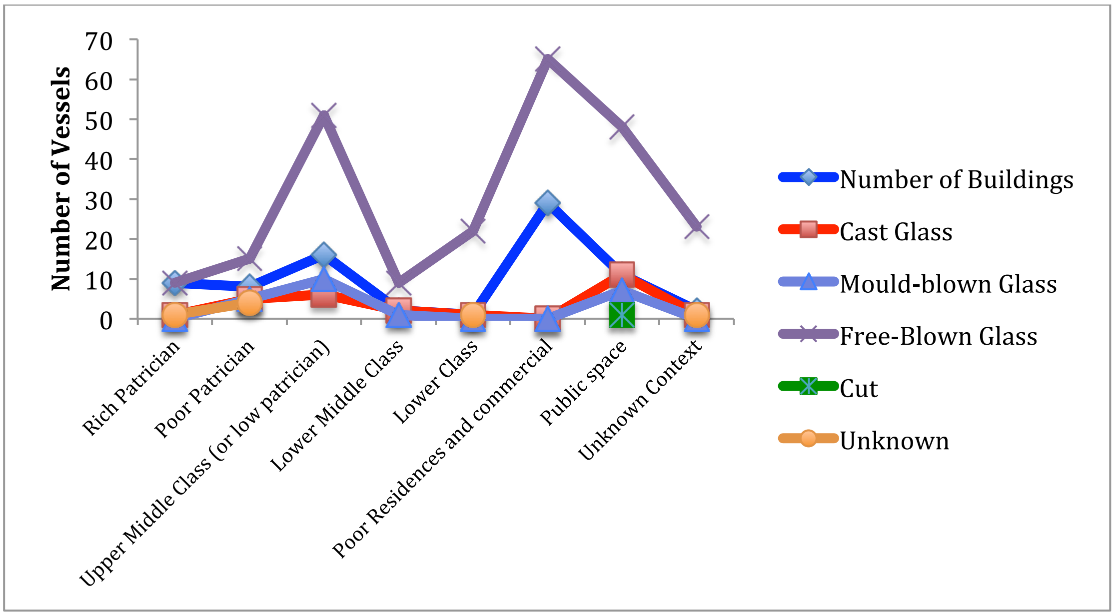


Figure 6.9: Distribution of glass in the Insula of the Menander by social context.

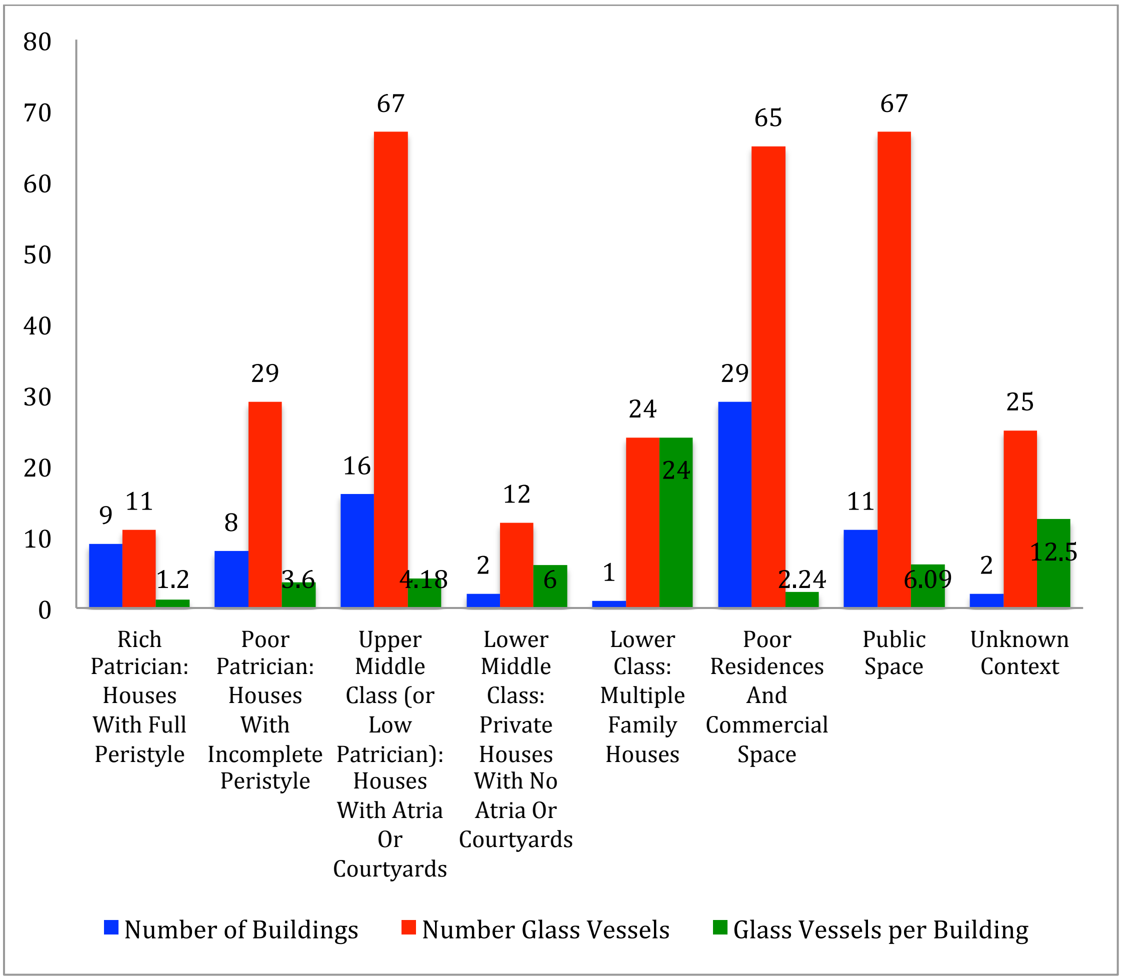


Figure 6.10: Comparison of find contexts with glass vessel numbers from the Insula of the Menander, Pompeii

There could be a number of reasons for these diversions from the trend line. 'Rich' patrician houses may have had finer wares in more open locations in which items were susceptible to breakage during the eruption, and the rich could afford more silver and may occasionally, at least in the House of Menander in Pompeii, Region I, have preferred it as a sign of status[99] (Allison 2006: 447-448; De Carolis 2004: 75 Table A). As noted before, the size of the rooms in lower class houses may have provided a degree of shelter to their wares, which may have been thicker, more utilitarian wares, allowing for higher survival rates. Public spaces may also have higher rates of glass due

[99] Silver is a material that can be shown to be luxurious as it has a quantifiable price, since the weight of silver determined the value of silver coinage. An example of an average sized silver cup from Boscoreale, buried in the same eruption that buried Pompeii, weighing 485 grams was the equivalent of 125 *denarii*. In A.D. 79 a soldier would have been paid 225 *denarii* per year, meaning a single set of four cups could pay two legionaries for a year with 50 *denarii* left over (Oliver 2004: 23; Alston 1994: 114).

to materials carried out of structures onto the streets, by the volcanic surge, as with the several pieces noted from the edge of the *Decumanus Maximus*. There may also have been glass vessels used in public ceremonies at temples, for offerings, and they were certainly used in bathing, as containers for oils and perfumes.

In Pompeii, there is too much material to go into a discussion about distribution across the whole city, but De Carolis' (2004: 71-79) study allows for an interesting look at Region I, which was a residential and commercial district with a the full range of social contexts being represented, except for public buildings, or areas. De Carolis does not provide data for the distribution of forms or the distribution of production types, but does provide the number of vessels for buildings of each social context, and represents that number as a portion of the total vessel assemblage of all materials so that it is possible to see how glass relates to other materials.

Looking at the two highest social levels, determined by De Carolis, glass is well represented in regard to the numbers of vessels, but glass vessels are lower percentages of the total number of vessels of all media than at any other social levels. In these two categories, where we find the highest levels of silver, the average percentage of glass tops out at 37 per cent, where it is above 40 per cent of vessels at the three lower social levels (De Carolis 2004: 77; Tables 6.11-6.13). This indicates that glass was a common and affordable item, and the low percentage here is likely related more to the ability of these classes to afford vessels of a variety of materials, and to the durability issues of fine glass, which have already been discussed. It is worth noting that bronze, silver, and fine ceramics are well represented in the two middle class categories (Table 6.12) and, in some cases, outnumber the same types of vessels in houses of the top tow levels. This could indicate either fluidity in wealth and class within De Carolis' class identification structure, or that fine ceramics and possibly even some metal vessels suffered greater destruction in the spacious upper class houses in the same way that has been suggested for glass.

Table 6.11: Vessels in each house with of the highest two social levels (After De Carolis 2004: 75 Tables A and B).

Housing with full peristyle	**Glass**	**Bronze**	**Fine Ceramics**	**Clay pots**	**Silver**
Casa del Menandro (I, 10, 4)	40 16.5 %	52	11	21	118
Casa di Paquio Proculo (I, 7, 1)	14 32.5 %	9	9	11	
Casa I, 8, 2	10 62.5 %	3		3	
Average percentage of glass	**37 %**				
Houses with Incomplete Peristyle	**Glass**	**Bronze**	**Fine Ceramics**	**Clay Pots**	**Silver**
Casa dei Quadretti Teatrali (I,6, 11)	18 37.5 %	22		3	5
Casa del Sacerdos Amandus (I, 7, 7)	4 28.5 %	6	1	3	
Casa dei Cubicoli Floreali (I, 9, 5)	7 21.2 %	16	2	8	
Casa I, 16, 2	12 41.3 %	3	10	4	
Casa della Statuetta Indiana (I, 8, 5)	39 59 %	22	4	1	
Casa I, 12, 7	5 17.2 %	19	4	1	
Casa dei Quattro Stili (I, 8, 17)	16 33.3 %	17	11	2	2
Casa del Fabbro (I, 10, 7)	41 41 %	38	13	8	
Average percentage of glass	**34.8 %**				

The middle classes (Table 6.12) show a fairly substantial increase in the percentage of glass vessels being used, but silver vessel numbers, which are high in the House of the Menander (the wealthiest context in this study), drop off and are completely absent in the lower middle class houses with no *atria* or courtyards.

Table 6.12: Vessels in middle class houses by material (After De Carolis 2004: 76 Tables C and D).

Houses with Atria and Garden or Courtyard	**Glass**	**Bronze**	**Fine Ceramics**	**Clay Pots**	**Silver**
Casa I, 9,8	15 15.9 %	16	18	45	
Casa di M. Fabius Amado (I, 7,2.3)	14 60.8 %	6		3	
Casa I, 11, 5	28 73.6 %	5	2		3
Casa I, 8, 14	18 16.8 %	38	10	32	9
Casa di Sutoria Primigenia (I, 13, 2)	43 60.5 %	16	11	1	
Average percentage of glass	**45.5 %**				
Houses without Atria Courtyards and Gardens	**Glass**	**Bronze**	**Fine Ceramics**	**Clay Pots**	**Silver**
Casa di Lesbianus (I, 13, 9)	41 50.6 %	23	9	8	
Casa I, 11, 7	52 55.9 %	37	3	1	
Casa di Granius (I, 8, 13)	3 23 %	3	5	2	
Average percentage of glass	**43.1 %**				

The lowest classes (Table 6.13), represented by combined domestic and commercial space, and multiple occupancy houses, have lower overall glass numbers, but they have smaller spaces and smaller numbers of items in general than the rich. If one looks at all of their vessel possessions, however, they actually have the highest percentage of glassware compared to vessels of other types of any social class in Region I of Pompeii.

Table 6.13: Vessels in commercial and domestic spaces by material (After De Carolis 2004: 77 Table E).

Commercial and Domestic Spaces	**Glass**	**Bronze**	**Fine Ceramics**	**Clay Pots**	**Silver**
Bottega I, 11, 3	12 50 %	10	1		1
Hospitium I, 14, 8.9	34 60.7 %	17	3	2	
Termopolio I, 11, 15.6	4 40 %	4	1	1	
Officina di Successus (I, 8, 15)	2 33.3 %		1	3	
Average percentage of glass	**46 %**				

6.5 Relationship to Pottery and Metalware

De Carolis' study leads directly to the comparison of glass use to pottery and metalware use in Pompeii and Herculaneum. De Carolis shows that the proportion of glass vessels, in relation to vessels of other materials varies between 34.8 per cent and 46 per cent (De Carolis 2004: 77), and when looking at glass in comparison to individual vessel media it can appear to have a great position of prominence. Studies of areas such as the Insula of the Menander may be the basis on which the Stern based her claims on the prominence of glass being so great that in Pompeii it outnumbered thin-walled ceramics by as much as 2 or 3:1 (Stern 2004: 103). Table 6.14 does, in fact, show glass as greatly outnumbering thin-walled ceramics at every social level. If only glass and thin-walled ceramics are counted glass makes up 79 per cent of the vessels. This example must be treated with caution, and not used on its own to highlight the relation of glass to pottery because it is not a like-for-like comparison of vessels for the same use. This issue can be illustrated by the 79.7 per cent in the first column of table 6.14. This figure makes it appear that glass was taking over from thin-walled ceramics and was being used at a rate of greater than 3:1. However, this figure includes the findings from the House of Menander, in which there were 40 glass vessels and only 11 fine ceramic vessels (De Carolis 2004: 75). If one then looks at the publication of excavated material from the house of Menander it becomes clear that few of the glass vessels actually fall into the same fine tableware category as the thin-walled ceramics. Only seven of the glass vessels are in the category of cups or bowls, and there is only one serving jug. Other uncategorised fragments are mentioned, which may add to the tableware numbers, but this number is still not much higher than the number of fine ceramic vessels. The majority of the glass vessels recorded in the House of Menander findings are storage containers, including jars and bottles, or unguentaria and ointment jars (Allison 2006: 63-153). If the view is widened to look at the whole insula of the Menander (Region I, 10) Then storage vessels make up an even greater portion of the glass assemblage, outnumbering the cups or bowls that could be compared to thin-walled vessels by 74[100] vessels to 15 (Allison 2006: 443-444). The storage containers, not to mention toilet items, are not directly comparable to the thin-walled ceramic tableware, so the image of glass taking over from ceramics, that Stern's ratio presents, is not appropriate.

Table 6.14: Percentage of all vessels in each social context (descending in wealth from left to right following the categories in tables 6.11-6.15) represented by glass and fine ceramics (After De Carolis 2004: 78) Glass is nearly 4 times the level number as fine ceramics, nearly twice the percentage of clay pots and very similar in number to bronze (1.5:1).

Glass vs. Fine Ceramics	**Table 6.11**	**Table 6.12**	**Table 6.13**	**Table 6.14**	**Table 6.15**
Glass	79.7 %	74 %	76.5 %	71 %	82.6 %
Fine Ceramics	20.3 %	26 %	23.5 %	29 %	17.4 %
Average percentage of glass	79.7 %				
Glass vs. Clay Pots	**Table 6.11**	**Table 6.12**	**Table 6.13**	**Table 6.14**	**Table 6.15**
Glass	66.1 %	70 %	67.6 %	80.5 %	78.6 %
Clay Pot	33.9 %	30 %	32.4 %	19.5 %	21.4 %
Average percentage of glass	72.5 %				
Glass vs. Bronze	**Table 6.11**	**Table 6.12**	**Table 6.13**	**Table 6.14**	**Table 6.15**
Glass	60.3 %	47.5 %	61.6 %	57.4 %	67.7 %
Bronze	39.7 %	52.5 %	38.4 %	42.6 %	32.3 %
Average percentage of glass	58.9 %				

What De Carolis' study illustrates is that, rather than taking over the roles of other materials on a large scale, and exploding in popularity as prized items that are suddenly available, glass did become popular but did not supplant the finest ceramics, or metalwares. De Carolis' work on vessel distribution also suggests that glass use likely reached its highest percentages, in relation to other materials, at the social levels where people were less likely to afford the finest metal and ceramic goods and, therefore, could use glass as an affordable substitute.

Comparing the glass vessels to vessels of other materials at Herculaneum, it is possible to look in more depth at vessel types rather than social distribution. Initial records showed that the Herculaneum assemblage included around 260 glass vessels,

[100] 61 bottles and 13 jars.

106 fine ceramic vessels, and 579 common ceramic vessels in the days of Maiuri's excavations (De Carolis 2004: 74-75). These numbers go toward supporting the idea of glass outnumbering fine ceramic tableware, although not all ceramics by any means. Like Stern's ratio, it ignores the fact that not all glass vessels are directly comparable tableware forms. From the vessel numbers of each category gleaned from the current site catalogue at Herculaneum (Siano unpublished) it is clear (Table 6.15) that glass was in no way replacing pottery as the leading material, and in the category of cups and bowls – including beakers and other drinking vessels – glass is more comparable to bronze, which still has a slight leading edge of 79 bronze vessels to 69 glass. In the cups and bowls category, ceramic vessels are more than three times as common as glass, with 220 examples. This proves that, despite all the Roman commentary about the quality and desirability of glass (Petronius, *Satyricon* 50; Seneca, *Epistulae Morales* 90.31), and despite some attempts to make it appear as though glass was the drinking material of choice, glass was almost certainly not the most frequently used vessel medium. Even taking into account that glass vessels are more fragile than many ordinary ceramic cups and bowls, and many certainly did not survive the destruction of Herculaneum, there is no evidence to suggest that it outnumbered, or even came close to, ceramics as tableware.

Table 6.15: Vessel numbers by vessel category and material at Herculaneum.

Vessel Type	Cup or Bowl	Plate/Tray	Bottle	Amphora/ Anforetta	Flask	Unguentaria
Glass	69	2	24	5	33	122
Ceramic	220	74	17	232	10	24
Bronze	79	46	0	15	14	11
Silver	1	0	0	0	0	0
Other	4	2	0	0	0	1
Vessel Type	**Jar**	**Pan**	**Pot**	**Inkwell**	**Mortar**	**Lid**
Glass	9	0	2	0	0	3
Ceramic	76	32	30	4	16	27
Bronze	12	17	17	1	1	1
Silver	0	0	0	0	0	0
Other	1	0	0	0	22	0
Vessel Type	**Aryballoi**	**Askoi**	**Jug**	**Simpulum**	**Casserole**	**Bath Dipper**
Glass	11	1	7	11	0	1
Ceramic	0	0	124	0	0	0
Bronze	0	1	74	6	73	17
Silver	0	0	0	1	3	1
Other	0	0	0	0	0	0
Vessel Type	**Crater**					
Glass	1					
Ceramic	0					
Bronze	1					
Silver	0					
Other	0					

It should be noted, that while it seem a reasonable argument that glass may have broken more than ceramics and its relative role has been underrepresented, ceramics too are fragile and most often found broken in the archaeological record. While some clay vessels may not break as readily as glass, fine tableware vessels, such as those often compared to glass are readily broken. Orton (1980: 156) actually discussed such ceramics specifically as items that are most often found broken in his discussion of fragmentary finds in archaeology.

Where glass does come out ahead of other materials is in a category for which it was used since the earliest core-formed glass vessel production. Unguentaria, aryballoi, and small flask are both represented far more than their clay or bronze counterparts.

These are small vessels that had long traditions in glass, and at Herculaneum they are almost exclusively produced through glassblowing rather than the time-consuming core-forming method in which they originated. Unguentaria forms are clear examples of where glassblowing would have drastically improved production speed and reduced costs, making them accessible to the population as a whole. Open forms such as plates, bowls, and cups, on the other hand, could be produced quickly through some mould-pressing and slumping casting techniques, (Stern 1993: 26) which may have started allowing for an increases in accessibility. Closed forms such as bottles and unguentaria would have been more reliant on the new technology. Since these forms were often used to contain scented or flavoured products for extended periods of time, there would have been strong motivation to select glass as a vessel material above porous ceramics, or metals that could contaminate the contents.

Glass bottles also outnumber their counterparts in other materials. A possible explanation for this, could lay in the square glass bottle's popularity as storage vessels. They were easily produced to uniform standards and packaged for shipping, made them the quickest and easiest way to store and transport liquids. It is more likely that the form was simply developed for use in glass, and that ceramic vessels for the same purpose fall into the well-established amphora/amphorisk category, which also allows for larger vessels that could carry larger quantities and were still easy to transport.

In every other category, glass is a supplementary material. Forms, including some jugs, *askoi*, bowls, and even *aryballoi* noted earlier, are frequently based on other bronze or ceramic forms, and the glass vessel numbers are not high enough to indicate that they are in any way replacing their counterparts other than perhaps for very specific purposes. Any specific purposes where this might be the case cannot be known without being able to discover their past contents or knowing the activities for which they were used. Glass may have served as replacements for prestige vessels at some of the lower social levels that could not afford silver or the finest ceramics, as the results form De Carolis' (2004: 71-79) Pompeii study suggest, but the prestige of glass does not seem to have replaced silver in the upper echelons of the Roman world.

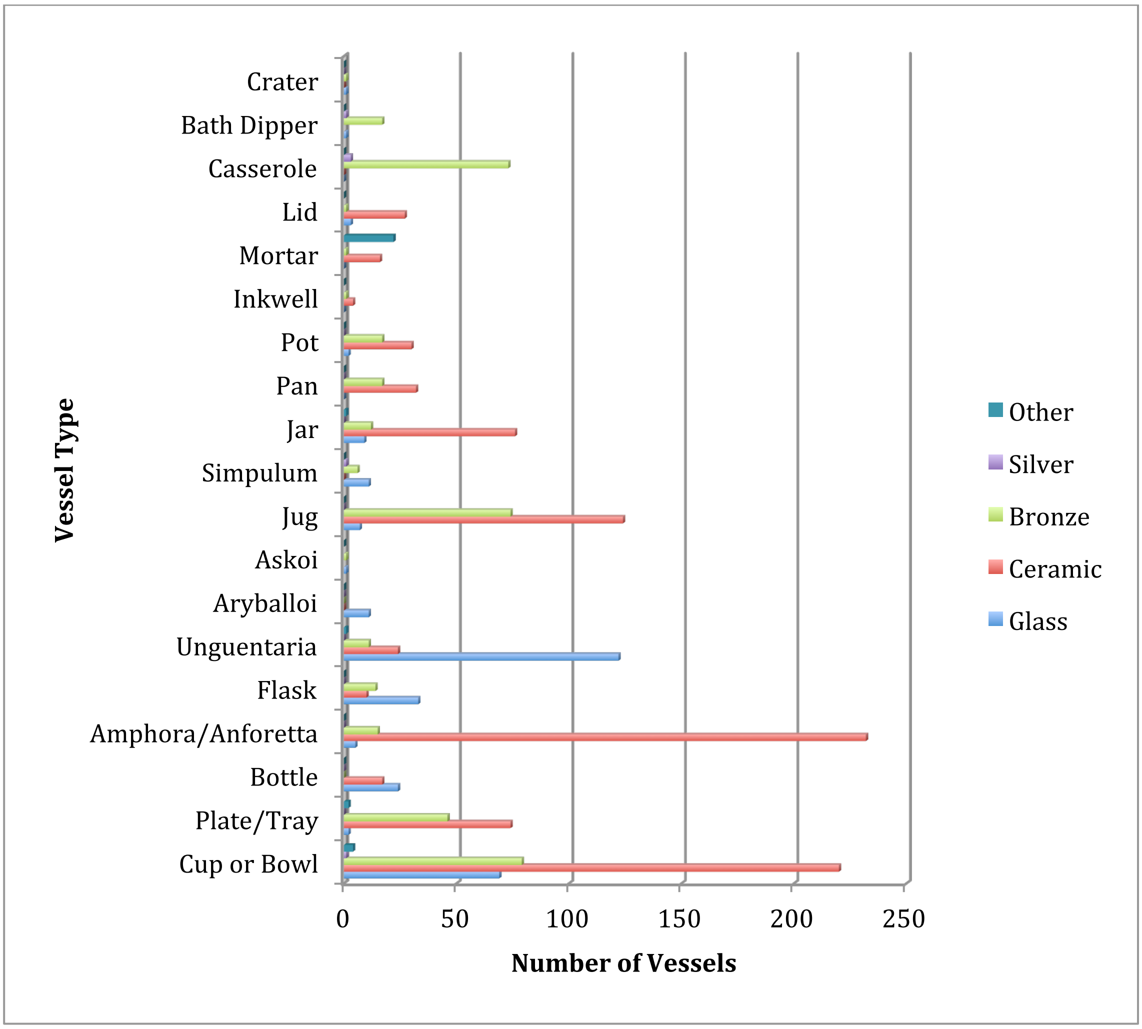


Figure 6.11: Vessel numbers by vessel category and material at Herculaneum (Data from Siano's unpublished catalogue of Herculaneum finds).

6.6 Conclusion

It does not appear that glass casting was reserved primarily for luxury items in Pompeii or Herculaneum, or that any one production type as clearly more prestigious or luxurious than another. Glass use was spread quite evenly across the Herculaneum excavation site, and the evidence shows that both cast and blown glass was used across the social spectrum. This indicates that it was not the blowing of glass alone that made glass affordable and accessible to the general public in the established civilian centre of the Roman world. While it appears that the moderately rich tended to possess more glass than the poor, it was not due to the prestige or high cost of glass, but because they could afford more of everything. Their wealth certainly would have influenced the forms they used, as they could have afforded more decorative wares, or more expensive perfumes, but whether the glass was cast or blown seems to have had very little influence on its social status.

Whilst no distinction can be made between production types and wealth, it is quite clear that on sheer numbers alone, blown glass was the most popular and accessible production type at Herculaneum. Despite the fact that cast forms are often thicker and have the potential to survive better, which could lead to a higher proportional representation among complete vessels, the total number of cast vessels is only nine per cent (Fig. 6.12). This is the lowest percentage of any site examined for this thesis, with two military sites – Nijmegen, Kops Hof; and Xanten, Vetera I – having cast glass accounting for more than one quarter of the assemblage.

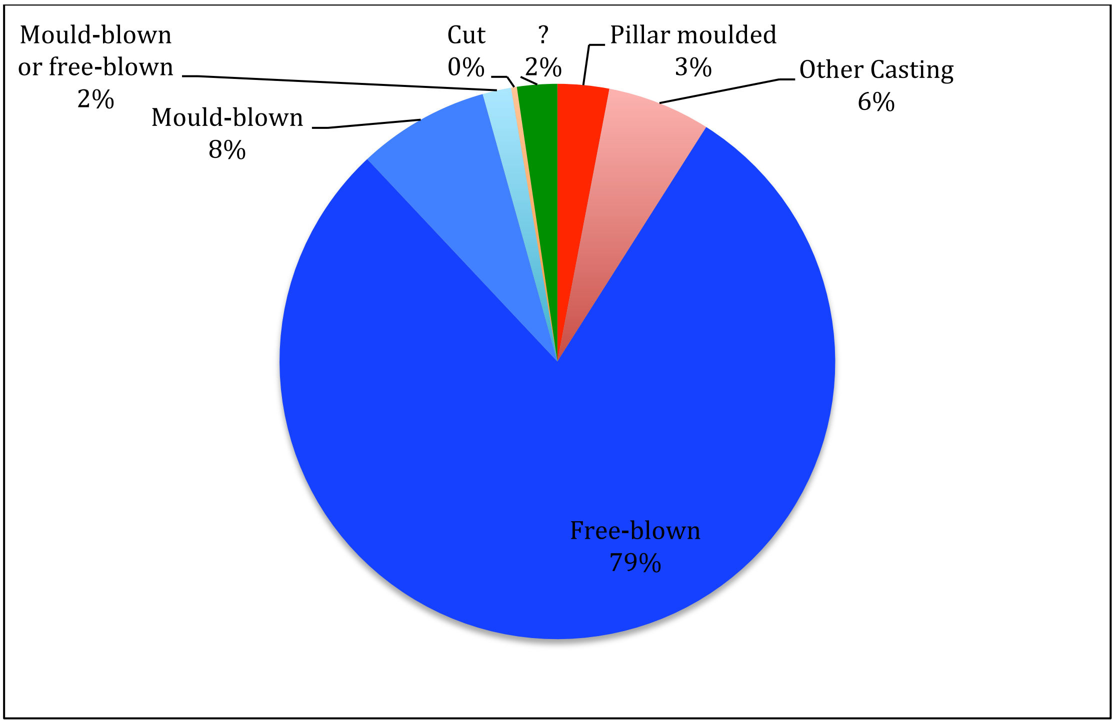


Figure 6.12: Total Herculaneum glass production proportions.

The numbers of vessels from different production types at Herculaneum and Pompeii may be explained in several ways, none of which has quite enough support to be more than a hypothesis. Firstly, it could indicate that blown glass was produced locally, and cast glass was imported, explaining the higher numbers of blown glass. There is great potential for glassblowing in the Bay of Naples, especially considering the presence of a perfume industry which often coincided with glass production (Giordano and Casale 2007: 22; Jashemski 1979: 276; Mattingly 1990: 81), and the presence of forms, such as the plain *askoi*, that are suggested to be local (Isings 1957: 77).

Secondly, the numbers might suggest that glassblowing had made glass widely available and had replaced casting in this region. If this were the case, then the cast vessels present were old rare items that simply had not yet broken and been discarded. One might then reasonably ask why, if glassblowing was so key to the expansion of glass from a rare item to a common one, the cast glass was not found strictly in wealthy contexts or as decorative heirlooms. Cast glass was found in a number of social contexts and was not limited to luxury items.

Another explanation could be that blown was being adopted whole-heartedly in the centre of the Empire among civilians who were interested in the newest thing and cheap products, but that cast glass, which had been around for centuries was not immediately abandoned and was also being used for affordable utilitarian vessels. The ratios at these sites, compared to the frontier fortresses, may be indicative of the spread of glassblowing from the East to the West. The technology likely was imported into the heart of the Empire before reaching the Western Frontier, and the armies would have already taken glass casting with them to the western provinces. As casting was still relatively new in the West it may not have been replaced as quickly. This directional spread, however, does not explain why the civilian settlement of *Oppidum Batavorum* at Nijmegen had similar ratios to Herculaneum ten years before the eruption of Vesuvius and may suggest that the differences in use had more to do with civilian and military tastes than with the spread of technology.

The final explanation is also problematic when the *Oppidum Batavorum* site is considered, because it would suggest that the difference in, the numbers between regions could be a result of ten years of change in the glass industry between the end of the Rhineland sites and the Vesuvian eruption. The Usk site, which has the latest foundation date, also had relatively low levels of cast glass, similar to Herculaneum, despite being military suggesting that tastes were changing over time. If not for the low levels of cast glass at *Oppidum Batavorum*, one could suggest that the difference in cast- to blown-glass ratios shows that the rate at which glassblowing was supplanting casting as the primary means of glass production accelerated in the interval between the destruction of the Rhineland sites and the destruction of Herculaneum. The similar levels of glass and the dates of *Oppidum Batavorum* and Herculaneum show that the decline of cast glass was tied more to context and preferences than to time.

Chapter 7 : Cross-Site Comparison

This chapter will look at the representation of different production types across all sites to see if glass use was consistent, or if there was any uniformity to the use and availability of glass vessels produced through casting and blowing. This chapter examines the patterns represented within military contexts and civilian sites, to observe the similarities and differences between their glass assemblages, and then compares the different civilian assemblages to examine the similarities and differences between the frontier and the heart of the Empire. After comparing all the first-century A.D. sites, this chapter reflects back upon the evidence from the second-century B.C. site discussed at the end of the literature review, and compares the role of glass prior to the invention of glassblowing. The changes in glass use after the new technology emerged are highlighted, and the importance of glassblowing in the spread of glass use to the ordinary Roman population is evaluated.

The sites compared in this chapter cover the broad social contexts of military and civilian life. The selection of military settlements includes both legionary fortresses and an auxiliary fort, and the civilian settlements represent urban environments in the long-Romanised heart of the Italian peninsula and a frontier town built up around the interaction between local Germanic tribes and the Roman army. The actual vessel numbers vary widely, and are impacted by the size of excavations and the retention policies. Therefore, in order to make a meaningful comparison of data between sites, the vessel counts must be considered in terms of percentages of the assemblage represented rather than by minimum numbers of individuals. If there are consistent patterns of use between sites, they will be more accurately depicted by examining the ratios of cast to blown vessels, and glass to other materials, than by looking at the vessel numbers within an assemblage. A simple illustration of this issue can be found in the comparison of pillar-moulded bowls in the Nijmegen Kops Plateau and Vetera I assemblages (Table 7.1). At the Kops Plateau fort, there were 44 bowls of this form, whereas there were 67 at Vetera I. It might appear, when using just these numbers, that these bowls were more prominent at Vetera I, but once they are looked at in terms of the percentage of each assemblage, it is noticeable that their representation is almost identical (23 and 21 per cent of their respective assemblages). If anything, the form is slightly better represented on the Kops Plateau, which has a smaller overall assemblage.

Table 7.1: *MNI* vessel distribution by production type from an urban context in the heart of the Roman Empire, three frontier legionary fortresses, and a frontier civilian settlement (*Oppidum Batavorum*) (Prior 2014: 120).

Production technique	Herculaneum	Usk	Xanten: Vetera I	Nijmegen: Kops Hof	Nijmegen: *Oppidum Batavorum*
Pillar-moulded	9	83	67	44	18
Other casting	18	5	22	12	7
Free-blown	234	572	142	104	169
Mould-blown	25	60	31	17	10
Mould-blown or free-blown	5	0	41	9	3
Cut	1	0	0	0	0
Core formed	0	0	1	1	0
?	7	0	9	1	1
Total	299	720	314	188	208

While the quantification methods used in the preceding chapters can provide useful data and can illustrate patterns emerging within sites, it is important to remember that the different situations surrounding the excavation and retention of materials, from each site, vary. Different conditions can affect the representation of glass use in the data. Table 7.1 illustrates one of the unavoidable issues that must be considered in discussions of such results. When looking at the row for the common pillar-moulded bowl (Isings 1957: 17-21, Form 3) it is easy to become concerned with the reliability of cross-site comparison. This is because these bowls represent only three per cent of the vessels (nine examples) at the highly preserved site of Herculaneum, whereas the other sites with lower preservation levels have much higher numbers of the same form. It is important, therefore, to consider possible reasons for this discrepancy. One reason could be collection biases. The excavations at Herculaneum have been taking place for well over a century, and were originally focused on finding artistic objects for display, rather than on scientific recording. This fact, combined with the sheer wealth of material has led to a collection and retention bias that favours complete or nearly complete vessels. In fact, in the study, represented by Table 7.1, there were no examples of vessels represented by one or a handful of fragments, as was the norm at all the other sites. If retention bias is the reason for the low levels of pillar-moulded bowls, one must ask why this form would be represented proportionally less than other forms. If broken vessels were discarded, one would expect that this would also drastically lower the numbers of other forms too. If anything, one might expect that a sturdy, thick-walled form like the pillar-moulded bowl would be over-represented as a result of this bias. That said, although pillar-moulded bowls may not shatter into fragments as small as thinner-walled vessels, their large open form does make them easier to break than some more structurally sound vessels with a tighter curvature. In this case, although it is difficult to judge, collection biases probably result in an under-representation of the total number of vessels in use at Herculaneum, but may not, in fact, be proportionally under-representing certain production types over others.

Another possible explanation for the low number of pillar-moulded bowls, relative to sites like Usk, could be social context. Hanel (1995 a: 242) has hypothesised that throughout the first century A.D. pillar-moulded bowls maintained popularity among soldiers. Perhaps the thick, relatively sturdy walls of pillar-moulded bowls made them appealing to soldiers who had to be more mobile than civilian populations.

Turning to Nijmegen, *Oppidum Batavorum*, the only other civilian settlement in Table 7.1 it is apparent that pillar-moulded bowls also represent less than ten per cent of the glass vessels in the assemblage. The three legionary fortresses, including that on the Nijmegen Kops Hof, which was recorded and conserved in the same way as *Oppidum Batavorum*, show pillar-moulded bowl percentages between 11 and 22 per cent of their total assemblages. This explanation requires further study to see if the pattern is present across a greater number of sites, but potential social differences must be considered when doing any sort of cross-site comparison.

7.1 Glass From All of the Sites

The glass assemblages from the sites in this study vary in size and have differences in the numerical representation of certain vessel forms, but they exhibit some clear similarities and distinct patterns in the types of vessels and quantities produced through the various methods discussed. At each site, it is clear that glassblowing was used to produce the majority of vessels. Glassblowing represents a mean percentage of 80.06 across all of the assemblages studies with a standard deviation of 9.21. This is no surprise, considering the traditional view that glassblowing was responsible for making glass production faster and cheaper, thus making it more accessible to the general population. Cast glass is, however, better represented than it would be if glassblowing had replaced it, or was the only method used to produce utilitarian vessels. Cast forms make up an average of 18.7 per cent of each assemblage with a standard deviation of 8.94. There are significantly different ratios of cast to blown glass from site to site (Table 7.2, Fig. 7.1), but there are noticeable similarities among some site types that indicate patterns of preference and use.

Cast glass is particularly well represented in the Rhineland military sites where there were some very wealthy, high-ranking individuals, such as legates and tribunes, but where the majority of soldiers were landless citizens on a fairly low annual salary (Alston 1994: 114). The cast material is also relatively well distributed across these sites, and is found primarily in plain, naturally coloured, utilitarian forms, suggesting that its use was not limited to the wealthy elites. Although the proportions of the cast glass are lower in the Usk and civilian assemblages, they are again largely made up of utilitarian vessels and are found scattered across the sites, rather than being limited to the wealthiest social contexts, where luxury goods might be expected.

Table 7.2: Percentages of assemblages represented by each production category.

Production Method	Usk	Nijmegen *Oppidum Batavorum*	Nijmegen Kops Plateau	Xanten Vetera I	Herculaneum
Pillar-Moulded	11.50	9.05	23.40	21.34	3.00
Mould-pressed	0.30	4.29	6.38	7.01	6.00
Core Formed	0.00	0.00	0.53	0.31	0.00
Unclear Cast	0.40	0.00	0.00	0.00	0.00
Total Cast	12.20	13.33	30.32	28.66	9.00
Free-Blown	79.40	80.48	55.85	45.54	79.00
Mould-blown	8.30	4.76	8.51	9.87	7.66
Mould-blown or free-blown	0.00	1.43	4.79	13.06	1.67
Total Blown	87.70	86.67	69.15	68.47	88.33
Cut	0.00	0.00	0.00	0.00	0.33
Unclear Method	0.00	0.00	0.53	2.87	2.33
Total	100.00	100.00	100.00	100.00	100.00

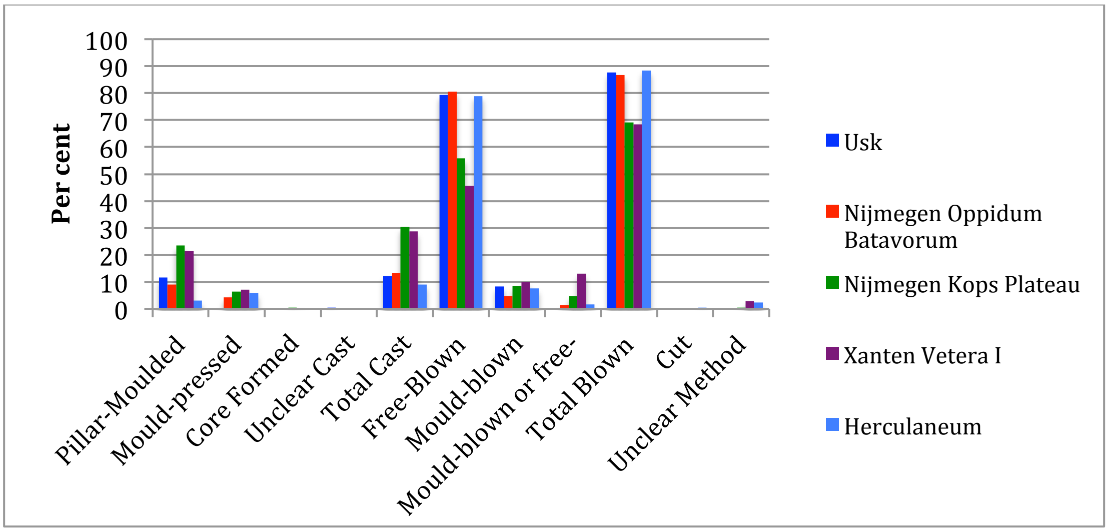
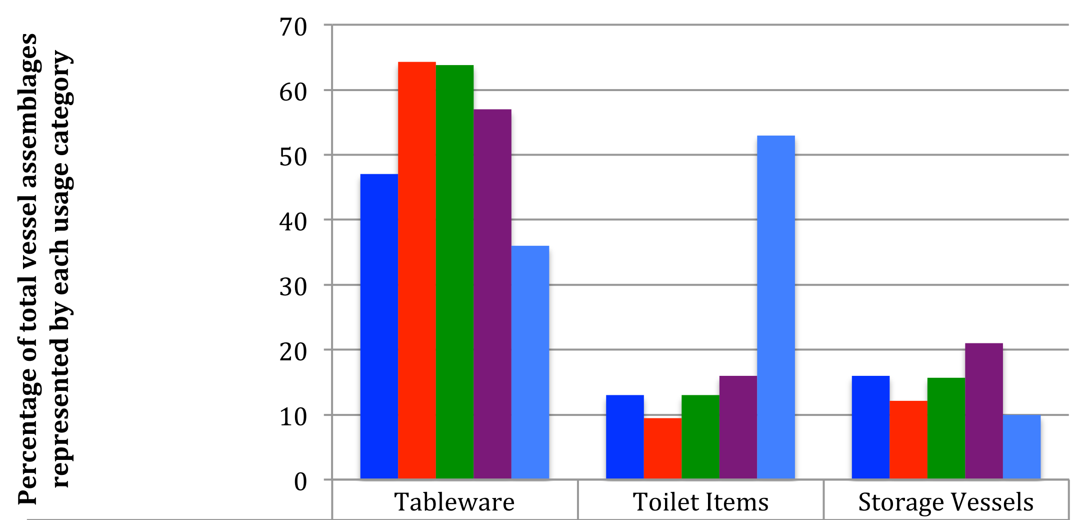


Figure 7.1: Percentage of assemblage production types in all case studies.

The types of glass used in the case-study sites are fairly similar, and, aside from a few exceptions, many of the individual vessel forms are repeated from site to site. The overall use of vessels seems to have followed a similar pattern across most sites, with most glass being classified as probable tableware (for serving as well as eating and drinking), and the remainder being fairly evenly divided between toilet items and storage vessels such as bottles or jars. The numbers appear to indicate that the occupants of Rhineland military sites made the greatest use of glass for tableware and storage, and the least use of glass in their toilet practices (Fig. 7.2), but other factors could well be in play. It has already been noted, in the Herculaneum chapter, that tableware had the potential to suffer greater destruction during the eruption of Vesuvius, whereas the durable compact forms of toilet items could have disproportionally preserved them.



	Tableware	Toilet Items	Storage Vessels
Usk	47	13	16
Nijmegen Oppidum Batavorum	64.3	9.5	12.1
Nijmegen Kops Plateau	63.8	13	15.7
Vetera I	57	16	21
Herculaneum	36	53	10

Figure 7.2: Division of glass vessels by purpose. *Nijmegen site values are the mean percentage of a range due to uncertain identifications.

7.2 Glass from Military Sites

The three military sites show an interesting pattern in cast vessels, particularly bowls of Isings Form 3. As can be seen in figure 7.3, there is a similar trend of cast glass usage in Xanten and Nijmegen, but it is significantly less prominent at Usk. While all three of these assemblages show that cast glass is in the minority, and that free-blown glass far exceeds glass of any other production method it is notable that whilst the Nijmegen fort and Xanten Vetera I have cast glass percentages that exceed the average by around ten percentage points, the cast proportion of the Usk assemblage falls well below the average. It has, in fact, the second lowest percentage of cast glass in this study. Usk's cast glass percentage is separated from Vetera I by 16.46, and from the Kops Plateau fort by 18.12.

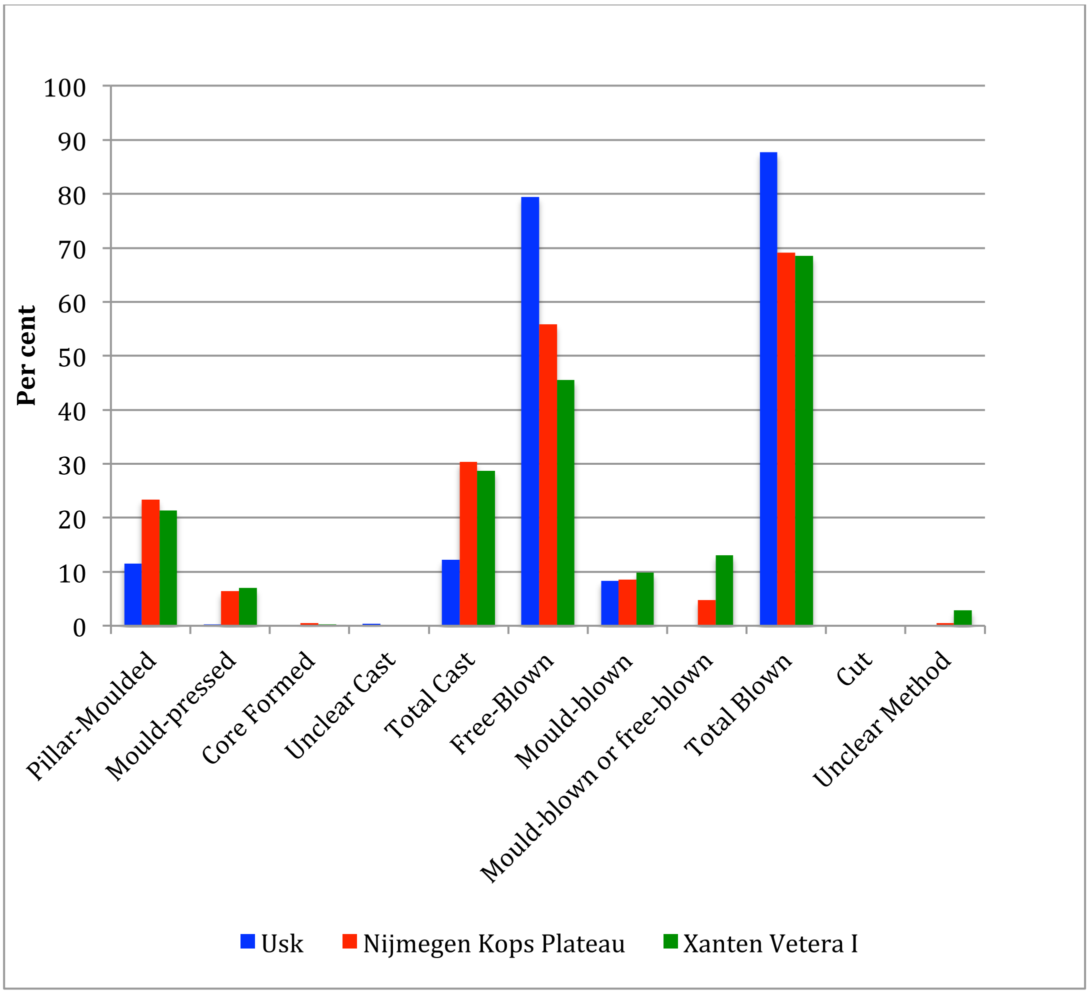


Figure 7.3: Production types at military sites.

The pillar-moulded bowl has its own columns on the chart (Fig. 7.3) due to the fact that at all three sites it exceeds all other cast vessel forms, and it is possible to produce through the slumping technique, which has been suggested as a method by which cast glass might have started to become affordable to the lower wealth levels of society. These bowls are present in large enough numbers to exceed ten per cent of each glass assemblage, reaching nearly one quarter of the glass in Rhineland sites. Although the percentage of pillar-moulded bowls in the Usk assemblage is the lowest of the military sites, it is still far from insignificant. In terms of minimum vessel numbers, Usk actually has more Isings Form 3 bowls than the other sites. Usk's pillar-moulded bowls also make up a much higher percentage of the cast glass (94 per cent), and despite their lower overall proportion of the assemblage, pillar-moulded bowls are the best represented of any individual vessel form at the site.[101]

At Usk, other casting techniques are almost invisible in the assemblage suggesting that the less cost-effective methods were not worth exporting to new provinces. All other casting techniques are represented by just five out of the 720 vessels in the assemblage (0.69 per cent), and they are barely even visible in the bar chart (Fig. 7.3). By contrast, casting techniques other than pillar-moulding make up six to seven per cent of the older Nijmegen and Xanten assemblages.

A possible explanation for the different levels of cast glass between Usk and the Rhineland sites is that the latter share earlier foundation dates. Nijmegen and Xanten were both established as Roman bases *circa* 13-9 B.C. under the reign of Augustus (King 1990: 42; Lendering and Bosman 2012:173; Lendering 2003), whereas Usk has an imprecise, but likely Neronian foundation date, and exists in a region that did not

[101] It is important to note that this does not mean that the Isings Form 3 bowl was the most commonly used vessel form. It is durable and easily identified, where many vessels with more delicate forms may be broken beyond the point where forms can be recognised.

commonly have glass until after Claudius' invasion of A.D. 43 (Price 1993: 67). This difference of at least 60 years may indicate that, although some forms of cast glass were still commonly used among soldiers, casting was in decline over the course of the first century in correlation with the rise of glassblowing and the spread of glassblowing technology to western sites. Visible evidence of this decline in the middle of the first century suggests that casting had remained a viable production option well after the invention of glassblowing, and that glassblowing was not so much cheaper and more effective that it became the sole desirable form of production. If glassblowing was making glass affordable to ordinary people, such as the ordinary legionaries of the first centuries B.C. and A.D., one would expect that casting would have declined rapidly, very shortly after the introduction of glassblowing. This would mean that a change in usage would not be visible between sites founded after glassblowing had been established in the Roman world. The significant number of slumped forms in mid-first century contexts, and the relatively late decline of casting does not appear to be limited to these military camps, but rather appears to be part of a wider trend. There is a similar significant portion of pillar-moulded bowls in first-century Castleford (26.21 %) (Cool 2006: 188), and at Colchester, where they make up the majority of the 13.60 per cent of the assemblage recorded as 'Large Bowls,' in Cool's study of dietary habits in Roman Britain (Cool 2006: 179). In spite of the presence of additional blown material from the second century, and possibly beyond, pillar-moulded bowls also make up significant percentages of the published assemblages from Rottweil and Bad Wimpfen, where they still make up the majority of cast vessels[102] (Hoffmann 2002: 43-47, 407-427)

The proportions of cast and blown vessels at military sites were not all uniform, but the types of vessels present appear in very similar ratios at the Rhineland forts.

[102] Rottweil: 12.14 % of the assemblage is Isings Form 3 (all forms of casting make up 14.04 %). Bad Wimpfen: 5.70 % of the assemblage is Isings Form 3 (all forms of casting make up 6.74 %).

Figure 7.2, in the previous section, shows that the percentage difference of each vessel category is less than seven percentage points. The percentage of tableware is significantly lower for the Usk fortress material, but the very fragmentary assemblage with a higher percentage of unidentifiable vessels likely influences this distinction from the other sites. Toilet items and storage vessels are not affected to the same extent, since many of their forms are durable and easily identified. These categories are represented at similar levels to their counterparts at the Xanten and Nijmegen military sites. Usk has less than one percentage point difference from the Nijmegen, Kops Plateau assemblage in both the toilet vessel and storage vessel categories, and only three and five percentage point differences in each category respectively from Xanten, Vetera I's toilet and storage vessels.

The close similarities between proportions of different vessel types and production methods suggest that the usage patterns were very similar at military sites throughout the western Empire in the mid-first century A.D. The items in these sites are not highly decorative or costly, and although mosaic cast glass was often found in higher concentrations near officer's houses at Usk and Nijmegen (Section 3.4, Section 4.2.1 Fig. 4.6, and Section 4.4), the general spread of glass covers most of each site. This suggests that glass was not just being used by people of high standing, and that the find distribution is not strictly indicative of collection in certain areas for recycling. The distribution patterns are indicative of loss and discard from a wide range of locations across each military site.

7.3 Military vs. Civilian

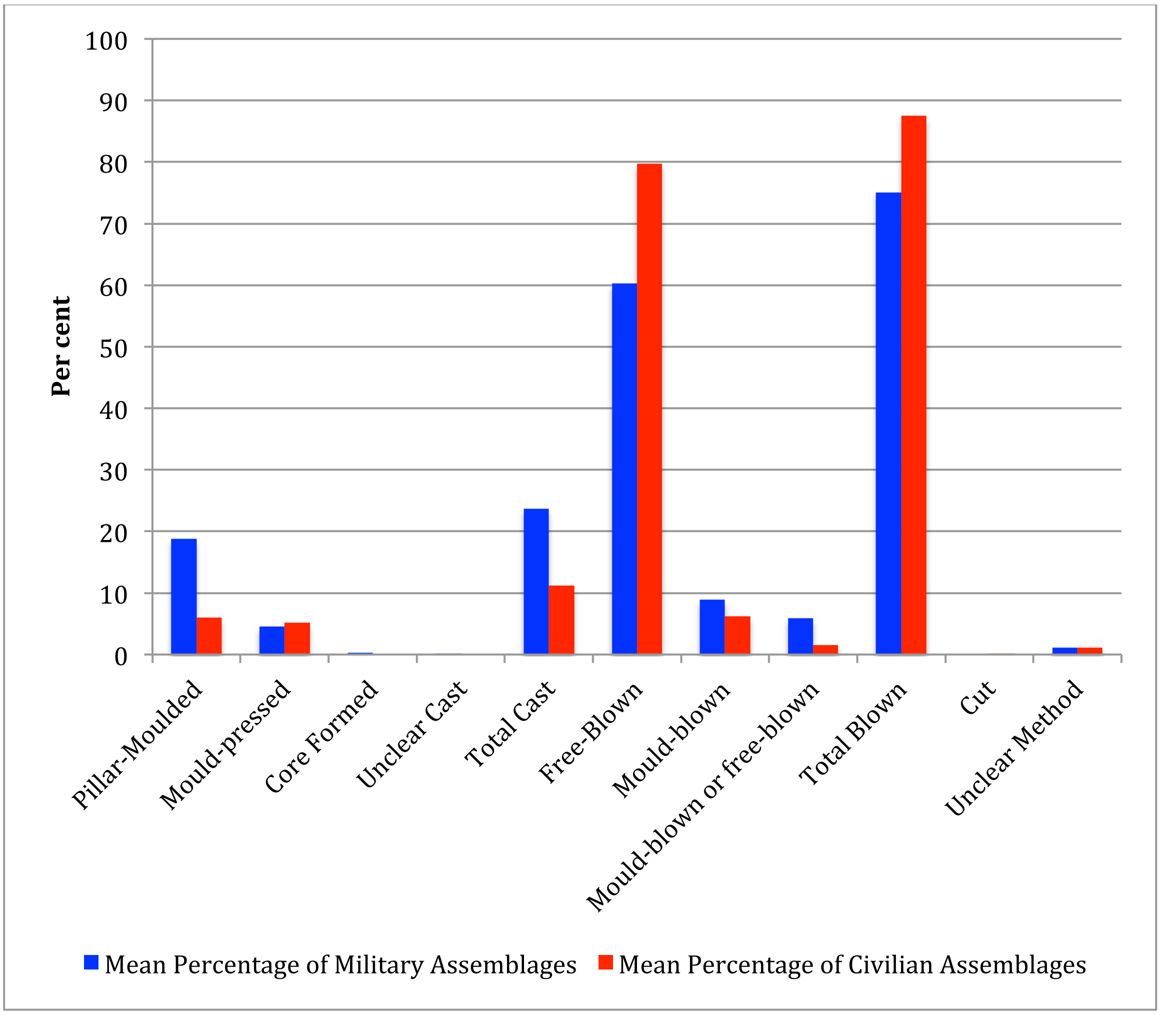


Figure 7.4: Average percentages for each production method: military vs. civilian.

The most notable difference in production types, from site to site, comes from a comparison of military and civilian sites (Fig. 7.4). An examination of the average percentages represented by each production technique in military assemblages to those in civilian assemblages upholds the pattern of glassblowing being the dominant production category, but exhibits a distinct trend toward a higher use of cast glass in military contexts, borne out almost entirely by the thick-walled Isings Form 3 ribbed bowls (Fig 7.4). The average percentage of military assemblages composed of pillar-moulded bowls was more than three times that of civilian assemblages (Table 7.3). The pattern would be even more extreme without the inclusion of the Usk site (Figure 7.5).

When all the military sites are included, the civilian assemblages actually have a slightly higher percentage of mould-pressed vessels, but, if Usk is omitted from the military average, leaving only Rhineland sites, then military sites show more evidence of mould-pressing, suggesting that the continental sites were founded toward the end of mould-pressing, but before pillar-moulding lost popularity. The latter was, therefore the one casting technique to have a significant spread in areas of later conquest.

Table 7.3: Representation of production types in military contexts versus civilian contexts.

Production method	Mean percentage of military assemblages	Mean percentage of civilian assemblages
Pillar-Moulded	18.75	6.03
Mould-pressed	4.56	5.15
Core Formed	0.28	0.00
Unclear Cast	0.13	0.00
Total Cast	23.73	11.17
Free-blown	60.26	79.74
Mould-blown	8.89	6.21
Mould-blown or free-blown	5.95	1.55
Total Blown	75.11	87.50
Cut	0.00	0.17
Unclear Method	1.13	1.17

Mould-blown items do not make up vastly different percentages of assemblages at either military or civilian sites with a difference of just over 2.68 percentage points in confirmed examples. Even if all the fragmentary vessel glass that was not clearly identified as free-blown or mould-blown, at military sites, is counted as mould-blown, the difference between military and civilian sites is still under ten per cent. If the scenario is reversed, and all potential mould-blown items are counted at civilian sites then the difference is just over one percentage point. The big difference among blown glass comes from the proportions of free-blown vessels, which differ by at least 13.53 percentage points and possibly by as much as 21 percentage points depending on how the “mould-blown or free-blown” categories of vessels are divided (Table 7.3; Fig 7.4).

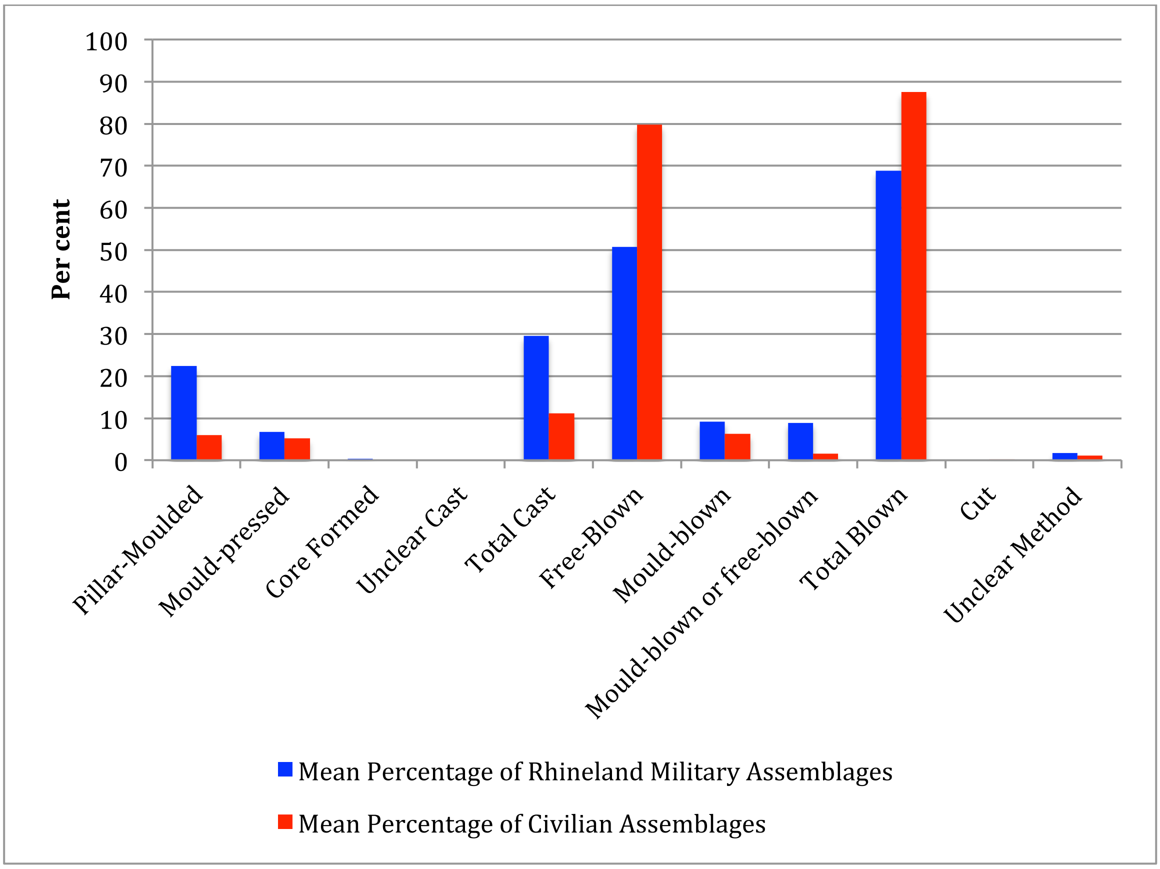


Figure 7.5: Average percentages for each production method: Rhineland military sites vs. civilian sites.

The patterns from the Usk assemblage compare very closely to the civilian assemblages (Figure 7.1), but as was visible in the section above, Usk was an outlier among the military sites in its relationship of blown to cast glass. If military settlements are taken together as a group, however, the pattern shows that cast glass is substantially more prominent among these military settlements. That said, it is important to note that these sites comprise just small samples of all the military and civilian settlements in the Roman world, and are not necessarily perfect representative examples of all sites of these types. However, as noted in the preceding section, preliminary engagement with the published material from other forts seems to uphold the general patterns. There was certainly variation across the Empire, concerning vessel size and function, based on regional tastes, but there is enough of a pattern emerging from these sites, despite the differences between them, to form a good hypothesis that is worthy of further study.

Between Xanten, Vetera I and the Nijmegen, Kops Plateau fort one can see almost identical usage patterns of different production types emerging (Figure 7.3), despite the fact that one was a double legionary fortress and the other an auxiliary cavalry fort. Alternatively, comparing the Kops Plateau fort and the civilian site *Oppidum Batavorum*, which are so close together that they fit within the same modern city, one can see noticeably different patterns of use, particularly in the use of cast forms. The difference between the two Nijmegen sites is nearly as strong as the visible distinction between the much further separated Vetera I and Herculaneum. If these patterns are present both on the small regional scale, and at the scale of the western half of the Roman Empire then they can be considered as potential indicators of an emerging pattern of use.[103]

Due to the collection and retention bias toward complete or nearly complete vessels, which can be seen in the Herculaneum assemblage and in Siano's forthcoming catalogue, it is possible that results are skewed in favour of durable materials. It is, therefore, conceivable that certain durable vessel forms may in fact be proportionally overrepresented. It was pointed out, in the chapter on Herculaneum and Pompeii, that small tubular unguentaria, which had a small, curved surface area that might improve survivability against the surge of boiling mud that buried Herculaneum (Carey and Sigurdsson 1978: 303-314; Luongo *et al* 2003: 171-172), made up a large portion of the blown glass assemblage. By contrast, thin-walled tableware, which could easily shatter, is poorly represented. Due to the difference in durability one must consider it possible that a higher percentage of the pillar-moulded bowls survived than did vessels such as beakers, meaning that this form, and cast glass in general, which tends to be relatively thick, had declined further, in the heart of the Empire, than can be seen in the results

[103] It is important to note that the distinctions between Herculaneum and the other sites in this study are entirely based on the present assemblages and cannot be deemed representative of Roman sites in general without further study.

recorded for this thesis. Thick-walled cast vessels may also have survived better than thin blown vessels at frontier and military sites, but the retention policies of the excavations at these sites minimises the underrepresentation of fragmentary vessels.

The percentages of vessels used as tableware, toilet items, and storage containers has already been discussed, as has the issue of the large difference between Herculaneum and the other sites. Comparing civilian to military use between the two Nijmegen sites, however, may be of greater interest. The difference in the percentages of tableware at these sites is less than one point, and there is a difference of around four percentage points in toilet items and storage vessels from these sites. The very similar patterns at these sites could indicate that, with regards to use as opposed to production type, regional context was more influential than civilian/military context. The practice of veterans retiring to settlements just outside of military camps where they had served (Keppie 1983) would have led to portions of both populations having the same practices in eating and bathing. There also would have been trade between the *Oppidum* and the soldiers, which may have included glass vessels and their contents. As there have not been any production sites identified in either the military or civilian settlements it is not possible to say which context may have been producing vessels and setting the trend, but glass was not used in *Germania* prior to the Roman arrival, so it stands to reason that the Roman armies brought glass to the site. Much of the early glass carried by soldiers may have been cast, but production soon shifted towards glassblowing, which is dominant at both sites, as glass use was spreading to the locals. Thus, while some usage patterns may have been similar, the civilians, who had not previously had glass, tended to use a higher percentage of newly made blown items.

The biggest difference between the Nijmegen military and civilian sites, aside from the production techniques represented, is not in the types of glass vessels they were using, but in the quantity. Civilians adopted glass on quite a large scale, and while it is not currently possible to compare to ceramics at these sites, due to them not being fully published, it is possible to see, from the glass reports, that there was a much higher density of glass finds in the civilian excavation. There were 209 vessels counted from the excavation of *Oppidum Batavorum*, as opposed to the 188 vessels found on the Kops Plateau, despite the excavated area being approximately 30 times smaller than the military excavation. Without more information on feature types and building identifications, which would come from a full site report, it is not possible to say what caused the increased demand. It would make sense for rapidly produced blown glass to be predominant if demand was increasing, but cast glass is not absent, nor is it luxurious, so this site is not indicative of blown glass being completely responsible for making vessel glass widely affordable. The difference in the cast to blown glass ratio may be indicative of the time period, in which Roman influence spread glass use to conquered populations, more than the cost of the glass.

7.4 Civilians: Frontier vs. the Heart of the Empire

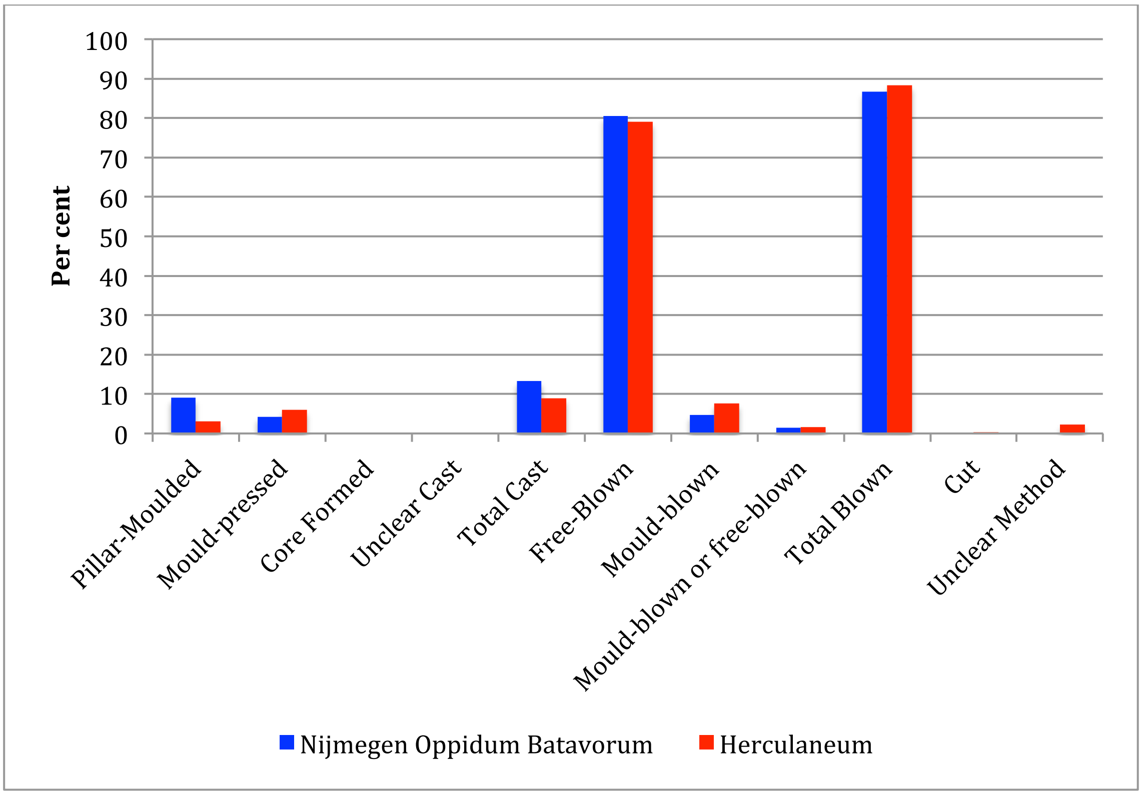


Figure 7.6: Production types at civilian sites.

There is very little distinction between the levels of different production types between the civilian settlements of *Oppidum Batavorum,* at Nijmegen, and Herculaneum despite the great distance between them and the very different social atmospheres (Fig. 7.6). The wealthy, thoroughly Roman, city of Herculaneum shows only slightly higher percentage of blown glass in its assemblage than the frontier settlement of relatively newly Romanised Germanic people and veterans. This difference is not borne out in the free-blown portion of the assemblage, which is actually marginally lower at Herculaneum, but is in the higher percentage of mould-blown glass at Herculaneum. The cast glass situation is similar in that both sites have total proportions just straddling ten per cent of the assemblage (Table 7.4). The site with the higher proportion, Nijmegen, only has higher numbers in one subdivision of casting. Herculaneum actually has a higher percentage of all cast vessels excluding the pillar-moulded Isings Form 3 bowl, which has an apparent pattern of prominence at military sites, such as the one next to *Oppidum Batavorum*. This distinction may have been even more pronounced in actual use, in the first century A.D., if the interpretation of the retention biases at Herculaneum and the possible overrepresentation of thick-walled forms is accurate.

Table 7.4: Production methods in civilian centres.

Production Method	Nijmegen *Oppidum Batavorum*	Herculaneum
Pillar-moulded	9.05	3.00
Mould-pressed	4.29	6.00
Core formed	0.00	0.00
Unclear cast	0.00	0.00
Total cast	13.33	9.00
Free-blown	80.48	79.00
Mould-blown	4.76	7.66
Mould-blown or free-blown	1.43	1.67
Total blown	86.67	88.33
Cut	0.00	0.33
Unclear method	0.00	2.33
Total	100.00	100.00

Cast vessels being less common in civilian cites than military ones is a recurring pattern that is upheld by the assemblages at Leadenhall Court, in London as well as at rural sites like Orton Hall Farm and Claydon Pike (Cool 2006: 191-192). There are, however, some exceptions, which suggest that more civilian sites would be helpful for confirming the pattern. Pillar-moulded bowls made up nearly 23 per cent of the glass assemblage at Causeway Lane, London and 57[104] per cent of the glass at the *vicus* of Castleford, where the fortress percentage was 26.14 (Cool 2006: 188, 189-192, 202-203).

[104] The military assemblage was more than twice the size of the civilian assemblage, so there may be issues of excavation bias.

7.5 General Patterns

The evidence suggests that there was a relatively consistent pattern in the relationship between cast and blown glass throughout at least the western half of the Roman Empire. In all cases, blown glass vessels greatly outnumber cast vessels, but cast glass still makes up a significant portion of each assemblage, composing about 17 per cent of the entire body of vessel glass from the main case studies (Fig. 7.7). The proportion of each assemblage that consists of cast glass appears to vary between civilian and military sites, and between the frontier and southern Italy, but cast glass vessels were shown to be regular finds, throughout the first century A.D. In spite of the growth of the newer glassblowing technology, casting technology continued to spread to newly Romanised territories where glass vessels had not previously been produced. Further study of Italian sites with more complete retention policies could, however, be valuable for confirming the levels of cast glass in the central Empire.

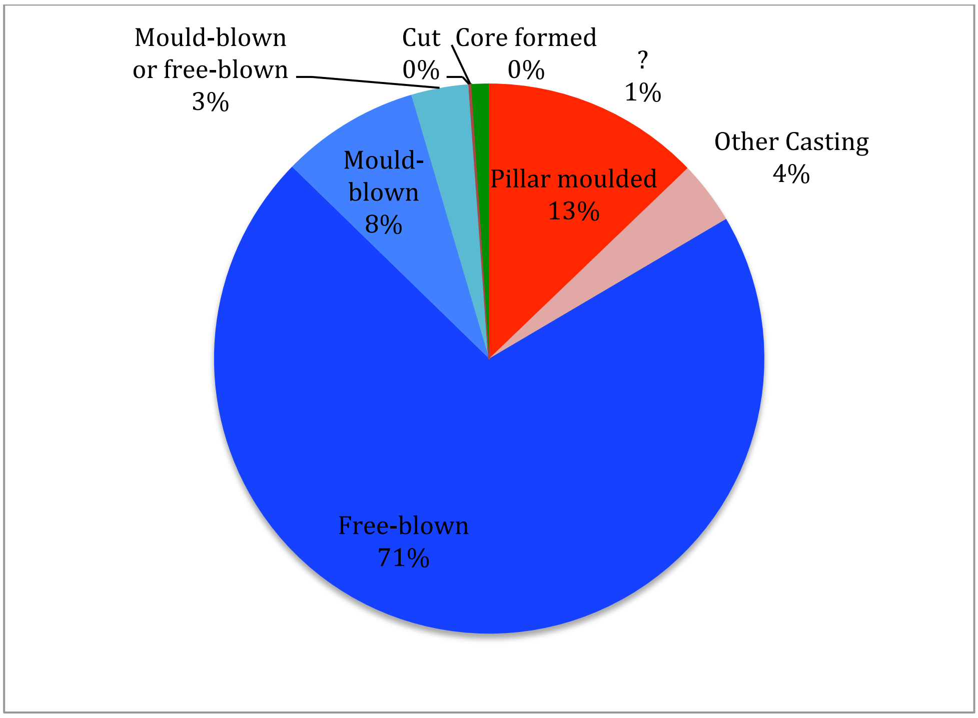


Figure 7.7: Production proportions from all case studies combined.

The types of cast and blown glass vessels show that both production categories produced decorative and utilitarian vessels and were used across a variety of social levels. If glassblowing had been entirely responsible for the spread of glass use beyond the social elite, then it would be unlikely for cast glass to fulfil significant portions of the utilitarian glass assemblages and be found in lower status contexts. The rapidly produced pillar-moulded bowl, which outnumbers every production method with the exception of free-blowing (Fig. 7.8), was the most common cast form on every site bar Herculaneum,[105] and the majority of these bowls were produced in natural blue-green glass, or in solid colours rather than complex, time-consuming, and costly polychrome patterns.

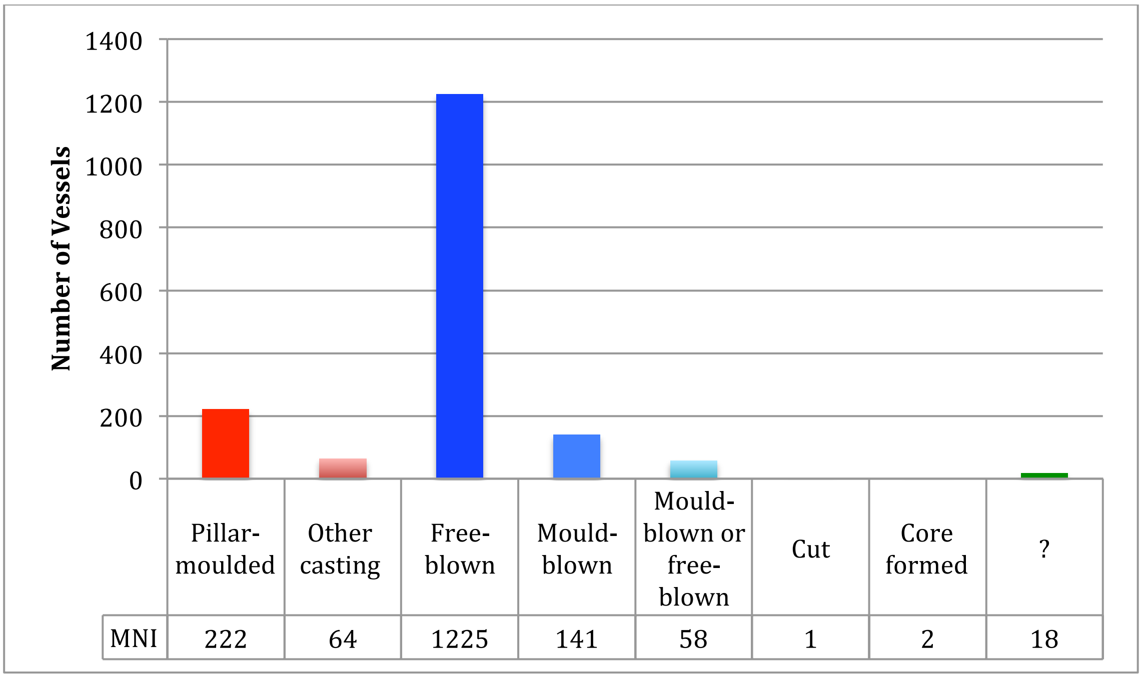


Figure 7.8: Minimum number of individual vessels of each production type from combined case studies.

There may be a slight visible decline in the use of cast glass between the Rhineland sites, and the sites of Usk and Herculaneum, which had later destruction dates, and the decline appears more prominent in sites such as Rottweil and Bad

[105] Most of the cast vessels at Herculaneum were open forms that could have been produced quickly in an open mould.

Wimpfen, which have second-century contexts included in their assemblages. The decline of cast glass in the 70s A.D. and beyond indicates that it had been a slow process and that casting had remained a viable, affordable production method well after the invention of glassblowing.

Further studies, with detailed contextual information and computer plotting, is necessary to provide a strong comparison of the distribution patterns of glass across Roman sites, but based on evidence from individual sites, it does not appear that cast and blown glass had widely different distribution patterns. In all sites, both production types are found in a variety of contexts, but the true level of distribution, particularly on military sites, requires more comprehensive excavations. The fortress excavations uncovered a greater proportion of the elite structures at the heart of the fortresses than of the barracks blocks of the ordinary soldiers. Although it is difficult to find sites that meet the requirements of this study, it would be useful to find some that focus excavations on a larger percentage of the barracks blocks, to enable evaluation of the production type percentages among the lower ranks, and to allow for stronger comparisons with the finds in the command structures and officers' houses.

Reflecting upon the case of Tel Anafa, from the first chapter (Section 1.3), it is apparent that glassblowing did not immediately eclipse casting on sites where glass vessels had previously been used. The evidence from Tel Anafa shows that the rise in popularity of glassblowing may have had a slow start and been more gradual than some grand claims suggest, because blown glass makes up under one per cent of the total glass from the Augustan and Julio-Claudian periods (Grose 2012: 3). The pillar-moulded bowl, on the other hand, made up 72 per cent of the glass assemblage (Grose 2012: 1; cf. Section 1.3 Fig. 1.7). Considering that, relative to the span of time and size of the occupation, there were more glass vessels used in the early Roman levels than in the Hellenistic levels, and that most of the vessels were slumped forms such as the pillar-moulded bowl, the Tel Anafa assemblage might suggest that it was slumping techniques, rather than glassblowing, that were beginning to expand the role of glass in Roman society. The combination of cast and blown glass in a variety of contexts across the studied sites which post-date glassblowing's initial rise to dominance, and the late decline of casting indicates that the spread of glass use and production preference may have had as much to do with other social factors as it had to do with new technologies.

A comparison of glass and ceramics is difficult, due to problems in confirming the purpose of many vessels, the recyclable nature of glass, and the inconsistent publication of glass. It has, however, been possible to compare the kinds of vessels and the numbers of glass and ceramic vessels present at some of the sites in order to make some judgements on whether or not glass was becoming popular for certain purposes. Unguentaria do not appear to have been popular in ceramics at any of the sites, suggesting that glass did come to dominate the unguent and perfume container industry, but storage vessels and tableware are always more popular in ceramics. Just comparing eating and drinking vessels from Usk, it is possible to obtain a ratio of 5.3:1 in favour of ceramic wares over glass, and at Xanten, ceramic forms that can be compared directly to glass forms outnumber their counterpart by a ratio of approximately 27:1, without taking into account the unknown quantity of glass lost to recycling. At Herculaneum, the ratio of ceramic cups plates and bowls to glass equivalents is closer to the Usk ratio, at 4.1:1 (cf. Section 6.6, Table 6.15). While these numbers are imprecise owing to the differences in publications and the aforementioned recycling of glass, they do not indicate a great change in the relationship of glass and ceramics from the earliest Roman layers at Tel Anafa, where blown glass was not prominent and where the relationship of fine ceramics to glass was only 5.5:1 (Slane 1997: 267, Fig. 6; cf.

Section 1.3 Fig 1.8). Tel Anafa shows, however, that the change in the relationship between glass and ceramics was greater between the pre-Roman and Roman periods, in which the ratio of plain ceramics to glass changes from 14.7:1 to 4.3:1 (Berlin 1997: 24). Again, this change happens in a period before glassblowing became prominent, so it appears to be casting techniques that were beginning to make glass more accessible and popular in the early Roman period. This would not have happened if casting was, by nature, incredibly costly and was reserved only for decorative, luxury vessels.

Chapter 8 : Conclusions

8.1 Interpretation of Results

This thesis has questioned past assumptions that glass was a luxury item in Rome, which became commonplace due to the technological advance of glassblowing, and that glass was so admired that it came to dominate certain markets once filled by the pottery industry. By studying the glass vessels from the first-century A. D. sites of Usk, Nijmegen, Vetera I, Herculaneum, and Pompeii, and comparing the relationships between cast and blown vessels, and between glass and ceramics, this thesis has shown that glassblowing did not suddenly replace cast glass, and was not the only widely-affordable production technique spreading the use of glass in the first century A.D. Comparisons to the ceramic assemblages of some of the case-study sites challenge the idea, suggested by some widely-published scholars (Stern 2004: 103), that glass surpassed ceramic use in many areas and show that, in direct comparisons of similar vessel types, ceramic vessels almost always greatly exceed their glass equivalents. The evidence presented shows that cast glass and blown glass were used side-by-side across a wide breadth of social contexts, and that both techniques were primarily used to create utilitarian, as opposed to luxury vessels.

The glass from each case-study site was evaluated, and the vessel types, fragment types and production types were documented. Through analysis of all fragments and complete vessels, an estimated minimum number of individual vessels was determined for each type, which could be divided to produce vessel numbers for each production type and vessel form. This allowed for an evaluation of the types of vessels for which each production method was used, and the types of vessels being used in each of the social contexts in which glass was found.

When looking at the prevalence of cast materials, and examining the pre-glassblowing assemblage from Tel Anafa, it is clear that glass vessels were already available to more than just the richest citizens, and glass use was on the rise. This early spread of glass shows that glass vessel use was expanding before glassblowing, and therefore the new technology could not be entirely responsible for the democratisation of glass use. All of the main case study sites and data from other sites in the regions of study provide evidence for the continued significant use of cast glass forms for over a century after the invention of glassblowing. The number of blown vessels is always higher than the number of cast vessels at the main sites, although not in the Augustan/Julio-Claudian layers at Tel Anafa, indicating that glassblowing gained popularity in the first century A.D. The continued spread of cast forms, and the fact that glass use was spreading before glassblowing indicates that there were factors other than the invention of glassblowing at work in popularising glass and that, while the invention of glassblowing may have provided a significant boost to production numbers, it did not negatively impact the pre-existing glass industry. Glassblowing simply opened doors to expand and specialise the industry.

Despite some variation in percentages between context types, such as military and civilian centres, all of the assemblages exhibit a blend of plain, utilitarian wares and decorative wares produced through both blowing and casting. The numbers indicate that the choice of cast or blown glass was likely influenced more by vessel use and preference than by affordability. Glassblowing was more effective at producing closed forms, and is therefore the dominant production type for those vessels. Open forms, on the other hand, could easily be blown or cast, but where large bowls were popular, casting appears to have been favoured. A possible explanation for this is that thicker cast walls added to durability in large, open pieces.

The literature shows that glass was a rare commodity before Rome, and that it held a position of prestige in several cultures (Stern 1999c: 39; Tatton-Brown and Andrews 1991: 24). Primary sources show that glass was recognised as having useful qualities and aesthetic qualities by Roman society. The Roman sources, combined with certain decorative wares, show that glass was granted a degree of esteem; but the numbers of ordinary utilitarian glass vessels in the archaeological record indicates that it was in no way a purely luxurious medium for vessels. In fact, very little glass of the mid first century A.D. appears to have actually been highly luxurious, although some was decorative. The forms seen in the assemblages show that glass vessels were used for a variety of everyday activities, in the century after the invention of glassblowing, including eating and drinking, bathing, performing toilet activities, and storing and transporting goods. If casting had been vastly more expensive than blown glass, and produced only luxury wares, it would not have persisted in the production of utilitarian wares right through the first century A.D. Furthermore, if cast glass was vastly more costly than blown glass, glass would be a much rarer find in the pre-blowing levels, and especially at the Roman levels where it still outnumbers blown glass at Tel Anafa.

Further study is required to develop a more complete picture of the earliest use of glass in the Roman world, in order to judge the early status of glass and the change undergone before the time period of the main case studies. The Tel Anafa assemblage provides evidence that even before the invention of glassblowing, there was fairly substantial glass use and many items were for ordinary use, but with more time and funding more sites could be analysed to test the Tel Anafa assemblage's status as a representative of its time.

In the primary studies there is little variation, between military and civilian, and frontier and urban Italian sites, in the vessel forms used, although the quantity of certain forms does vary. Soldiers appear to have had a greater preference than civilians for sturdy tableware forms like the pillar-moulded bowl; and civilians, particularly in wealthy Italian cities, owned greater numbers of perfume bottles, oil flasks, and unguentaria. That is not to say that soldiers did not use perfume bottles, oil flasks, and unguentaria. Soldiers exported Roman bathing practices, which involved the use of oils, and unguents, which were often treatments used for various minor afflictions, to the frontiers (Stewart 2007: 51). It is also clear that people in cities or in frontier civilian settlements still used cast bowls. Differences simply arise in quantity of use based on needs. Perfumes may have been more commonly used in civilian life than on campaign or guard duty, and the eating and drinking habits of soldiers may have made large durable bowl forms and storage vessels preferable to finer vessels.

The results of this thesis indicate that the significance of glassblowing as a rival to ceramics and metal ware has been overstated (Grose 1977: 9). Glass did imitate some earthen and metal forms, and may have been a cheaper surrogate for some, if the evidence from Vickers (1998) and De Carolis (2004) is representative of a wider trend. From the numbers found in the studies presented here, glass never posed a threat to the viability of the ceramic industry, and its use sometimes declines where luxurious metal vessels are used. Arguments about glass outnumbering ceramics do not hold up when only vessel numbers of the same form and function are compared. Glass vessels outnumber pottery of certain categories such as the thin-walled fine wares at Pompeii, but only if the whole glass assemblage is used as a comparison, including toilet items and storage vessels, which do not fill the same function as thin-walled ceramics and would not have taken market share from them. At every site studied, the total number of pottery vessels vastly outnumbered the total number of glass vessels.

In spite of the praise glass received from Roman writers, the archaeological evidence suggests that the majority of drinking and storage vessels continued to be produced in clay, and plates and dishes appear almost exclusively in pottery forms. The only glass vessel types that were seen, in the sites studied, that were notably absent in ceramics were unguentaria. Although most unguentaria are blown, they are almost all, with the exception of some highly decorative examples, in forms that could have been, and were, produced with pre-existing techniques such as core-forming. As a result, it is conceivable that glass could have already been taking over this role due to a preference for non-porous and unreactive materials for containing scented goods. Glassblowing could have produced these types of vessels more quickly than core-forming, eliminating the need to produce ceramic versions to meet demand, and unguentaria may then represent one of the only instances in which glassware actually appears to have taken over a large portion of the market from pottery.

The argument could be made that glass was used in much greater numbers than are visible in the remains, and was collected for recycling making it appear less in the archaeology of sites than it would have at the time. There is, no doubt, some truth to that, but the choice of sites for this study was limited to short occupation sites specifically to minimise this effect. Short occupations and relatively sudden demolition or abandonment events would have limited the cycles of use, breakage and recycling, and should have left much of the glass in use at the end of occupation to be deposited into the archaeological record. One can argue that percentage of glass vessels represented in the archaeology should be at least relatively comparable to other vessel materials, because it is not the only material that would be collected for reuse or recycling, preventing archaeological deposition. Like glass, vessels of other materials were frequently collected after breakage rather than left to future excavators. Metals could be melted down and reused just as well as glass, and they held more value than glass, making reuse even more desirable. Furthermore, metal does not shatter like glass, so during a recycling collection, metal objects are less likely to have been left behind.

There are more limitations for the reuse and recycling of ceramics, as they cannot be melted down, but they are not totally exempt from ancient collection and would not be represented as differently from glass as one might expect. This fact is highlighted in J. Theodore Peña's book *Roman Pottery in the Archaeological Record* (Peña 2007). His first chapter uses flow charts to compare the general artefact life cycle to that of pottery (Peña 2007: 7-9, Figs. 1.1 and 1.2). He notes many stages when maintenance could be carried out to renew the life of a ceramic vessel, and there are opportunities to reuse a vessel, or part of a vessel, for completely different purposes. This would remove the vessel from, or prevent it from entering, a discard context. Peña also indicates five points in which a ceramic vessel, or parts of a vessel, may be recycled as part of raw material in the production of something else. Parts of pottery vessels could be used form many different things. They were used as voting tokens, in the ancient Athenian practice of ostracism, bits could be used as filler in architecture, such as the central core of a rubble wall, or inclusions in concrete (Peña 2007: 11). Furthermore, as the present author witnessed in the Roman Agora in Athens, whole vessels could be embedded in a concrete wall to create structural hollows that helped lighten the load.

It is difficult to judge exactly how accurately any material is represented in the archaeological record, because there are vast numbers of variables that could affect the evidence. Items could be entered into or removed from a discard context at any time in their life cycles, they could be modified, deposited in different places, destroyed or simply discounted in collection and recording based on the biases and goals of excavators and conservators. The best hope there is for gaining an accurate depiction of the ratios of artefacts used in any point in antiquity is to look at as many sites as possible and get the most inclusive picture of the evidence available. From examining those ratios, it appears that the appearance of glassblowing did not significantly harm other industries, and although, in becoming the primary production method, it sped up glass production and the spread of vessel glass at a rate that casting could not have done, glassblowing does not appear be the sole explanation for the increased affordability of glass to the general population of the Roman Empire.

8.2 Challenges and Areas for Improvement

Difficulties arose when accurately quantifying fragmentary assemblages and determining how well they represent the quantity of glass that was used. Recording numerous variables for each glass find and then filtering to find overlaps and determine the minimum possible number of vessels, provides the most accurate and consistent count of the fragmentary materials at each site. Furthermore, studying sites with sudden abandonment or destruction phases, or with short periods of occupation made it possible to view assemblages as fairly sealed collections of material that were in use within the time period relevant to this study. Still, the archaeology will not have revealed everything that was used at that time for reasons such as ancient collection, destruction, loss or transportation out of the archaeological site context, omission in archaeological recording, retention biases, and simply missing things in excavation. Because of this problem, it is of key importance to focus on percentages, rather than actual vessel numbers. While it is likely that the overall vessel usage numbers are drastically underrepresented by the archaeology, it is probable that ratios of different production types are not greatly affected, and percentages can be meaningfully compared between sites of different sizes. This hypothesis appears to be borne out by the case studies above that have very similar patterns of production percentages among sites of similar types, regardless of excavation size.

A greater number of sites would have provided a statistically more meaningful study, but as explained in the discussion of site selections (section 2.2), finding relevant sites with suitable levels of excavation and recording is a great challenge in itself. The analysis of the growth of glassblowing and decline of casting could be improved with a full study of a pre-glassblowing site, and the incorporation of one or two sites, which date to the period between the mid-first century B.C. and the 70s A.D., or a site with a well-datable continuum of contexts. These types of sites are rare, meaning that improvements within feasible study sites are the most practical to achieve.

The case study at Usk would have benefitted from extra days of study at the location, to allow for collection bags containing multiple vessels of varying types to be split into separate database entries. The time constraints and the necessity of arranging the database by item bag, which, especially among the unpublished material, often included a combination of glass, led to some difficulty in identifying which colours or fragment types referred to which vessel within an entry. The written descriptions in the comments column aided in sorting out the data, however, data sorting and accurately matching variables slowed down the writing process.

The longer study period and better organisation of the material solved this problem in the Xanten case study, and made it easy to quickly produce clear unambiguous data entries that avoided the confusions present in some of the unpublished material from Usk. There were some challenges sorting out discrepancies between Hanel's published catalogue and the current study, and in distinguishing a few items that are erroneously stored together, but the experience of the Usk data collection, and the quality of published work allowed for better preparation and a more detailed study.

The Nijmegen studies could have benefitted from more information on the published material and the general excavation data. The lack of published ceramics and excavation records limited the distribution analysis and prevented any detailed analysis of pottery. At the time of the study, archaeologists were still working on producing a list of features and defining the contexts from which the material was excavated, and it was not possible to obtain this information within the time limit of this thesis. Had the absence of this information been known before undertaking this study it could have been assigned a longer time period, and applications could have been made to access unpublished excavation notes.

The Pompeii study would have been improved by better communication about the storage and recording of material prior to the study. Access to the excavation notes and the unpublished catalogue of materials, stored in the excavation offices at the Pompeii site, required separate permission from that granted for examining materials. Without this information, it was impossible to carry out the original goal of that part of the study and create a wide detailed survey of the glass use across Pompeii. Sampling buildings of a variety of social contexts from across the site, and recording all of the glass from each one would have created a valuable distribution study. This was made unfeasible due to the distribution of materials between the National Archaeological Museum, in Naples, the lack of complete catalogue entries that would allow for searching by region and building, and the nearly complete absence of contextual information for the glass vessels in the museum.

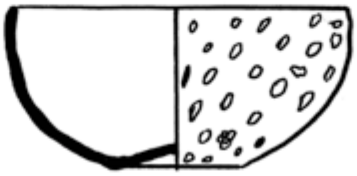
8.3 Future Work

This study has a large amount of room for expansion. With time and funding it would benefit from being extended to more sites across the Roman Empire including the Eastern Mediterranean, North Africa, and more varied urban and rural sites on the Italian peninsula. Case studies of some great villas could give a more detailed understanding of glass use among the true elites of Roman society, and with a variety of sites spanning some different date ranges it would be possible to create a better chronology for the spread of glass and the rate at which blowing replaced casting. The sites presented here were important for providing relatively sealed contexts, but most of them sprang into existence after both main glass production categories (cast and blown) were available, and only really provide snapshots of the different levels of each type of glass in a narrow window of time. An ideal scenario would be to find several sites that have excellent recording of strata from both before and after the advent of glassblowing to really get an idea of how usage changed in areas where cast glass was well established, and how “luxurious” cast glass actually was in the Roman Republic. Such sites would also help to track any ceramic forms that may have been replaced by glass forms as was suggested by Grose, when speaking on the unparalleled abundance of glass vessels produced in the early Empire (Grose 1989: 241).

Appendix 1: Form Drawings

All images presented in this appendix were drawn by the author and are numbered after forms documented in Isings 1957 catalogue of forms, except where otherwise noted.

A) Cast Vessels

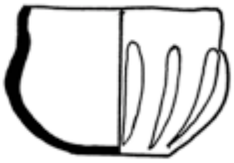


Form 1: h. 6 cm

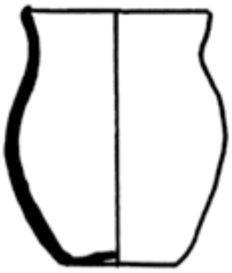
Form 2: h. 4.4 cm

Form 3: h. 4.4 cm

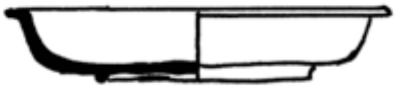
h. 4.4 cm



h. 7 cm.



Form 4: h. 8 cm

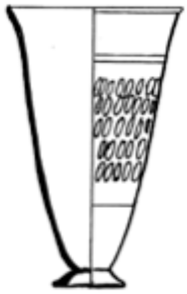


Form 5: h. 3.6 cm

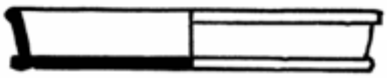
Form 18: h. 4 cm

Form 19: h. 2.6 cm

Form 20: h. 4 cm



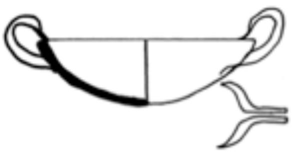
Form 21: h. 17.6 cm



Form 22: h. 2.8 cm

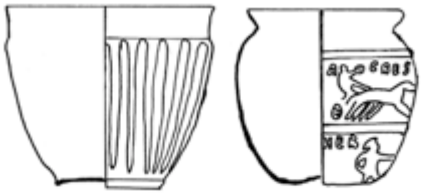
Form 23: h. 2.4 cm

Form 24: h. 4.1 cm

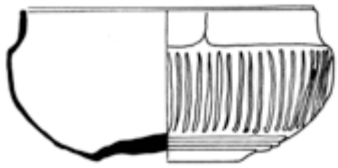


Form 25: h. 5.7

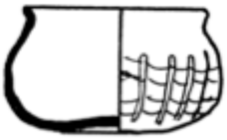
B) Mould-Blown Forms



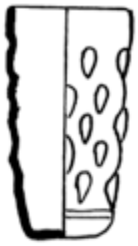
(After Price and Cottam 1998: 62, Fig. 15)



(After Price and Cottam 1998: 61, Fig. 14)

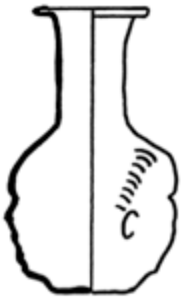


Form 17: h. 5.7 cm



Form 31: h. 14 cm

Form 78a: h. 10.2 cm



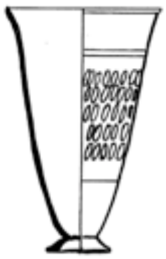
Form 78 b: h. 9 cm

Form 78 d: h. 8 cm

Form 78 e: h. 7.8 cm

C) Free-Blown Forms

1: Beakers

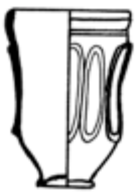


Form 21: h. 17.6 cm

Form 29: h. 10 cm

Form 30: h. 10.5 cm

Form 32: h. 14 cm



Form 33: h. 12 cm

Form 34: h. 12.5 cm


Form 35: h. 13 cm


Form 36 a: h. 14 cm


Form 36 b: h. 9 cm


Form 36 c: h. 13.8cm

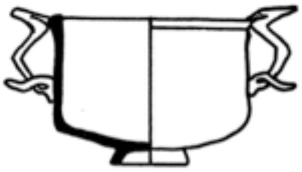

Form 37 a: h. 10.5 cm

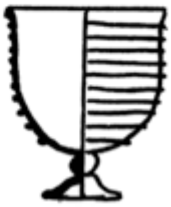

Form 37 b: h. 12 cm

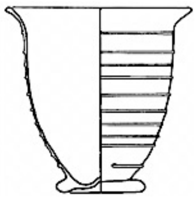

Form 37 c: 14.5 cm


Form 38 a: h. 9 cm


Form 38 c: h. 10.5 cm


Form 39: h.8.6


Form 40: h. 12 cm

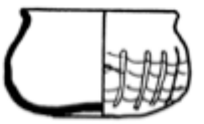

(After van Lith 2009: 23, Fig. 3)

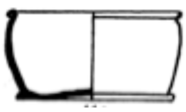
2: Cups


Form 12: h. 6.6 cm

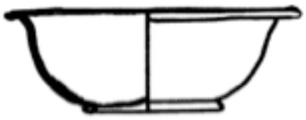

Form 12: h. 7 cm

3: Bowls

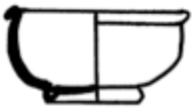

Form 17: h. 5.7 cm

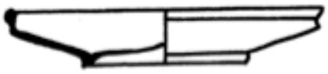

Form 41 a: h. 3.5 cm


Form 41 b: h. 7 cm

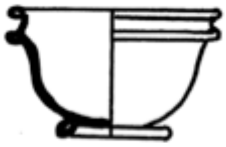

Form 42: h. 4.7 cm


Form 43: h. 4.2 cm


Form 44: h. 4.4 cm


Form 45: h. 3 cm


Form 69 a: h. 4.7 cm

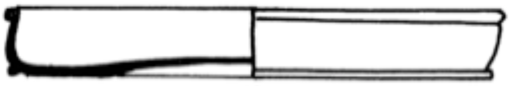

Form 69 b: h. 6.8 cm

4: Plates


Form 46 a: h. 4.8 cm

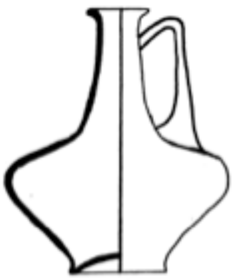

Form 46 c: h. 1.7 cm

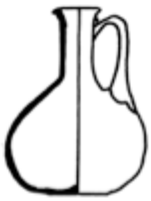

Form 47: h. 3 cm

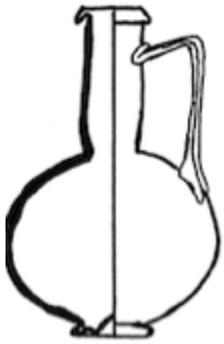

Form 48: h. 2 cm

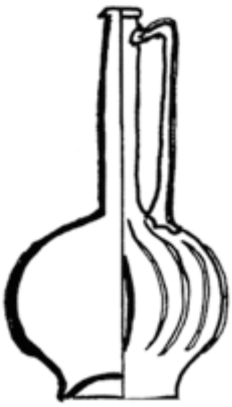

Form 49: h. 2.6 cm

5: Jugs


Form 13: h. 18.8 cm

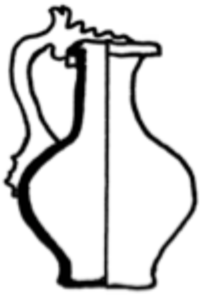

Form 14: h. 11 cm


Form 52 a: h. 23.1 cm


Form 52 b: h. 26.5 cm


Form 52 c: h. 17.5 cm


Form 53 a: h. 11.3 cm

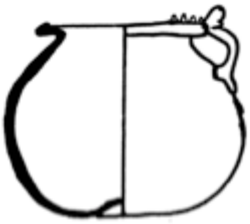


Form 54: h. 13.2 cm

Form 55 a: h. 29.5 cm

Form 55 b: h. 21.5 cm

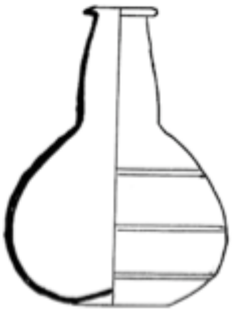
Form 56: h. 7.7 cm



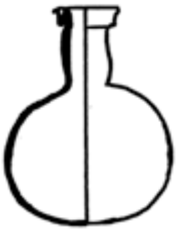
Form 57: h. 10 cm

Form 58: h. 12 cm

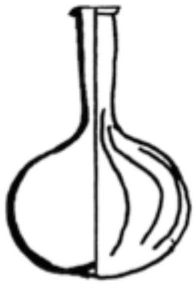
6: Flasks



Form 16: h. 24.5 cm



Form 70: h. 13.5 cm



Form 71: h. 16 cm

Form 72: h. 24.7 cm

7: Aryballoi

Form 61: h. 8 cm

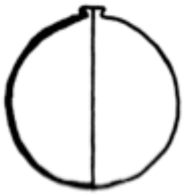
8: Unguentaria



Form 6: h. 5.5 cm

Form 8: h. 13.2 cm

Form 9: h. 9 cm




Form 10: h. 8 cm

Form 11: br. 18.5 cm



Form 26: h. 6 cm

Form 26: h. 5.2 cm

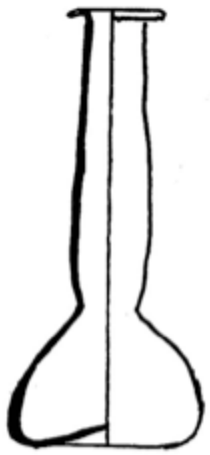
Form 27: h. 11.7 cm



Form 28 a: h. 10 cm

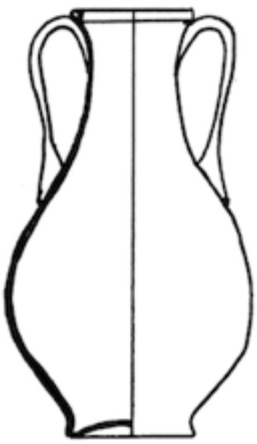
Form 28 b: h. 11.8 cm

Form 68: h. 5 cm



Form 82 A 1: h 16 cm

9: Amphoriskoi

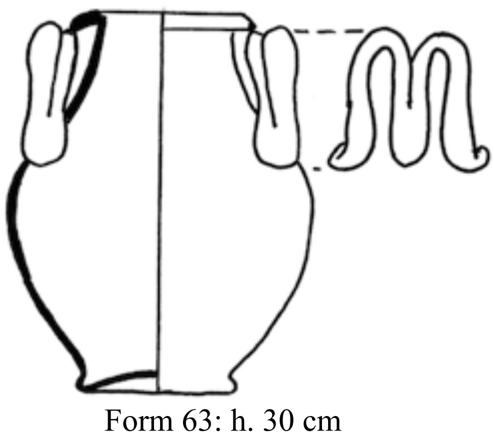


Form 15: h. 24.5 cm

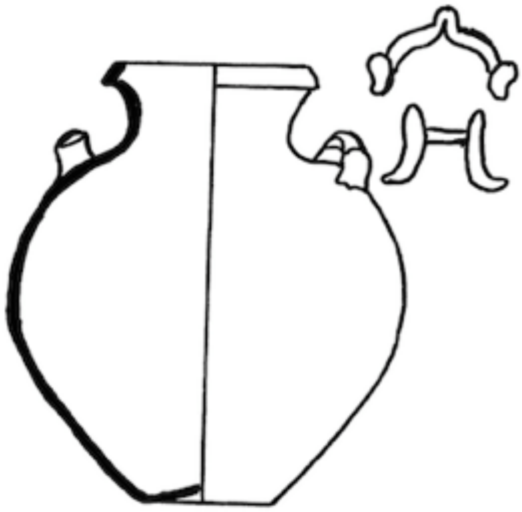
Form 60: h. 41 cm

10: Jars

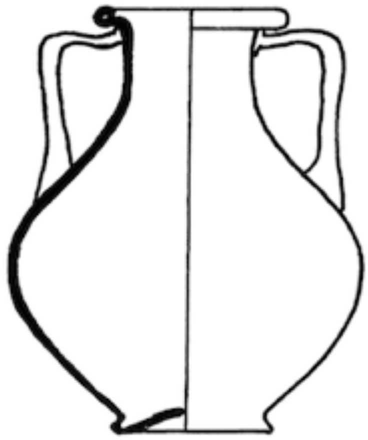
Form 62: h. 11.3 cm



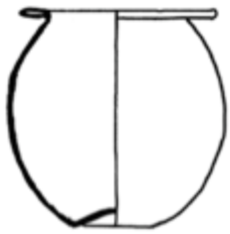
Form 63: h. 30 cm



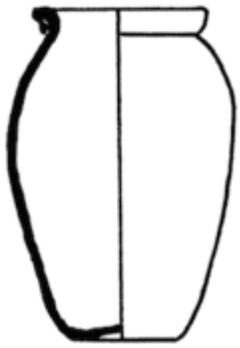
Form 64: h. 28 cm



Form 65: h. 26 cm



Form 67 a: h. 16.2



Form 67 b: h. 23.5 cm

Form 67 c: h. 18 cm

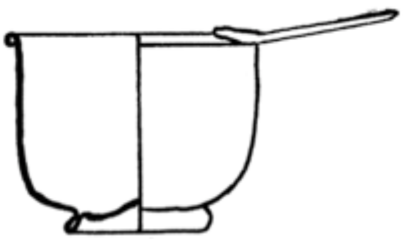
11: Bottles

Form 50 a: h. 11.5 cm

Form 51 a: h. 10 cm

12: Trullae

Form 75 a: h. 6 cm

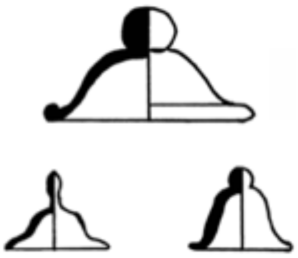


Form 75 b: h. 9 cm

13: Askoi

Form 59: h. 10 cm

14: Lids



Form 66 a: h. 4.5-5.8 cm

Form 66 b: h. 6.1 cm

Form 66 c: h. 5.7 cm

Form 66 d: h. 7 cm

15: Funnel

Form 74: h. 10.8 cm

Appendix 2: Worksheet Abbreviations and Variable Numbers

Abbreviations

- BDM – Base Diameter
- DM – Diameter (widest point)
- RDM – Rim Diameter
- * – Immeasurable

Variables and Number Codes

Type Of Vessel:

- Beaker: 1
- Cup: 2
- Beaker Or Cup: 3
- Bowl: 4 (.1 Pillar Moulded)
- Plate: 5
- Platter: 6
- Jug: 7 (.1, Conical)
- Unguentaria: 8
- Goblet: 9
- Pitcher: 10
- Amphoriskoi/ Amphora: 11
- Skyphoi: 12
- Cantharos: 13
- Flask: 14
- Bottle: 15 (.1 Cylindrical: .2 Prismatic)
- Jar: 16
- Unknown: 17
- Slag: 18

Fragment Type

- Rim: 1
- Body: 2
- Base: 3
- Handle: 4
- Shoulder: 5
- Belly: 6
- Large Part Of A Vessel: 7
- Whole Vessel: 8
- Melted: 9
- Neck: 10
- Handle Trail: 11
- Applied Decoration: 12

Colour:

- Clear-Colourless: 0
- Natural Yellow/Green: 1
- Natural Blue/Green: 2 (.1=More Green: .2= More Blue: .3 Greyish BG)
- Yellow/Amber: 3
- Light Green: 4
- Dark Green: 5
- Light Blue: 6
- Dark Blue: 7
- Purple: 8
- Brown: 9
- Red: 10
- White: 11
- Green-Colourless Translucent: 12
- Polychrome: 14
- Black: 15
- Deep Aquamarine: 16

Manufacture:

- Cast: 0 (.1 Pillar Moulded; 0.2 Core Formed)
- Free-Blown: 1
- Mould-Blown: 2
- Production Waste: 3

Rim Description

- Cracked Off: 0
- Fire Rounded: 1
- Folded In: 2
- Folded Out: 3
- Folded Out Up And In: 4
- Moulded/ Tooled: 5
- Folded Out And Under: 6

Rim Shape

- Everted: 0
- Inverted: 1
- Vertical/Straight: 2
- Trefoil: 3
- Horizontal: 4
- Triangle: 5
- Tubular: 6

Handle Description

- Strap: 0
- Rounded: 1
- Ribbed: 2

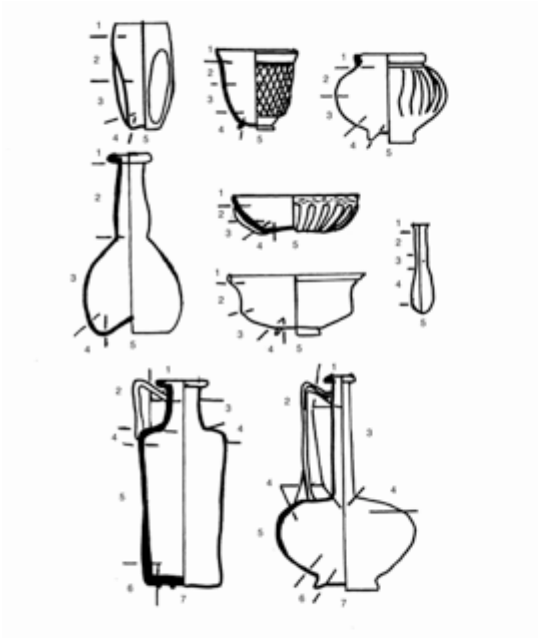
Handle Shape

- Floating: 0
- Dolphin: 1
- Angular: 2
- Rounded: 3

Base Type

- Flat: 0
- Blown Ring Base: 1 (.2 Open Ring)
- Concave: 2
- Applied Solid Ring Base: 3
- Out-Splayed Solid Base Ring: 4
- Convex: 5
- Applied Pad Base: 6

Vessel Zone



Cool and Baxter's Vessel Profiles Showing Zones (After Cool and Baxter 1996: Fig. 1)

Appendix 3: Worksheets (On Disc)

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